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W. J. JOHNSTON, Editor and Publisher.

T. COMMERFORD MARTIN, JOSEPH WETZLER, } Associate Editors.
G. H. STOCKBRIDGE, Assoc. Editor Patent Department.
CLARENCE E. STUMP, Business Manager.
WALTER T. HUNT, Advertising Dept.

New England Office, 48 Congress Street, Boston.
W. I. BARKER, Manager.

Western Office, 44 Lakeside Building, Chicago.
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New Advertisements.

In the growth of THE ELECTRICAL WORLD in circulation, size and general improvement, the value of its columns for reaching those engaged in electrical pursuits or interested in electrical matters has not failed to be appreciated by advertisers. Readers will find it to their advantage to keep their eyes on the advertising as well as the reading columns. The following are the new advertisements in this issue:

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VOL. X. NEW YORK, DEC. 24, 1887. No. 26.

THERE is promise of lively debate in Congress over postal telegraph bills. Senator Cullom is hopeful that his own plan, giving the government a brand new system under the Post-Office, will be adopted, but other proposals are being put forward and will get a hearing.

RECENT figures from Italy show a total of 7,844 telephone subscribers in that country, these being found in the twelve leading cities. The proportion to population is not a large one, but is up to the European average. There are practically as many telephone subscribers in New York City as in all Italy; and yet we have an investigating committee to find out why a "bloated monopoly" is allowed to restrict the use of the telephone here.

WE print on another page Mr. Arthur Steuart's weighty paper on revision of the patent law. It will be seen that Mr. Steuart made out a strong case, and some of his recommendations, if not, indeed, all of them, might well be adopted for the improvement of the patent system, should it be deemed advisable now to urge the reforms necessary. We hope to make an extended note next week of the paper, as well as of the discussion called forth by it.

THE thermo-galvanic or heat cell, designed by Case, and first brought out over a year ago, has, as noted in another column, been recently improved by the application of the amalgamating process. By this means the tin deposited in a powder from the cold solution of chromic chloride of brought together and converted into a well-conducting, continuous mass. Interesting as this cell is, it will be remembered that its E. M. F. is low, and that its action, depending upon the heating and cooling of a solution, is intermittent.

A STEP which may some day prove to have been the first toward governmental control in England and France of all submarine cables has just been taken in the decision arrived at by the British Post-Office and supported by the French authorities, to end in 1889 the present arrangement with the Submarine Telegraph Company. This practically places the company at the mercy of the government, as it will have to sell out for what it can get. Probably the bargain will not be a hard one, but the precedent thus set up may be troublesome in time to come. The principle under which the Channel cables become national or international property will apply just as readily to cables across the Atlantic.

NOT the least amusing feature of the work done by the telephone investigating committee in New York was its endeavor to prove that the telephone was a "necessity," and not a business "luxury." The committee has hied away to other scenes, with the serene satisfaction of knowing that it has established for New York the rule or dictum that whatever a business man here is willing, unsolicited, to pay $150 a year for is a necessity. After all, what a great city we live in, when nearly 7,000 shrewd citizens can pay not less than $150 apiece every year for a mere "necessity" of commercial existence! If Dr. Holmes could only rewrite a well-known poem of his, how glad he would be to include the telephone with those few other simple trifles of plain living.

IT will be remembered that a commission was appointed by the New York Legislature in 1886 to report on the most humane method of capital punishment. The commission consisted of Elbridge T. Gerry, Matthew Hale and Dr. Southwick. The commission is now understood to be wholly in favor of some electrical mode of executing death sentences. Dr. Southwick has been making various experiments during the summer upon dogs in the pound at Buffalo, as noted by us some time ago. Perhaps the recommendations of these gentlemen may not be carried into effect, but it is significant that they have been made. Electricity is already so often and so successful a deterrent from crime that there would be some fitness in this further and even more effectual use of it. The effect on the imagination of the habitual evildoer, of resort to such a weird method of capital punishment might not be small.

AN indication of the manner in which electrical power distribution is gaining ground is to be found in the decision of the municipality of Geneva, Switzerland, to supplement its present hydraulic system by putting in electric motors, the current for which will be generated by the water power of the Rhone. The city authorities evidently believe that it is often better, for many social, moral and other reasons, to carry power to the workers than to crowd them together into the huge factories that have become so marked a feature of these industrial times; and it is fresh in our memory that just this view of the case was urged at Philadelphia last February, before the electric light convention, by Mr. J. F. Morrison. Electrical distribution of power is found to be highly economical, and if it provides, as it now promises, means for the prosecution of new industries and for the refinement of old ones by individual artisans and mechanics, in their own homes, it will produce some very striking results in the arts and manufactures. Geneva is not long to be left alone in this work.

THE discussion of Mr. Wm. Stanley's valuable Institute paper on the phenomena of retardation in the induction coil shows that though much has been brought to light regarding the action of the induction coil there still remains considerable to explain, and that a wide field for investigation is open to original research. The phenomenon described by Mr. Stanley, in which a circuit of lamps shunted by "choking" coils gave a higher E. M. F. with one lamp cut out, brought out a number of theories regarding its probable origin. If no error of observation has been made in this instance, which, we opine, still remains to be proved, there would seem to be here a case in which, under certain conditions, an E. M. F. of alternating polarity could be maintained independently within a circuit of different potential. Mr. Stanley also brought out during the discussion a novel method of distributing alternating currents by obtaining an increased potential in a coil single wound, which potential is reduced to the initial potential by a similar coil at the other end of the line. Where the ratio of the increase of potential desired is small this arrangement may be advantageous, but the employment of this device, where the ratio is large, would necessitate very large coils, as compared with the induction coil wound with the usual primary and secondary. Altogether, Mr. Stanley has rendered public service in thus calling attention to these highly interesting phenomena and problems.

OUR editorial remarks last week as to the activity prevalent in the electric lighting field have attracted some little attention. The point we made as to the fact that the business had left behind the "retail" stage and had reached the "wholesale," has been generally appreciated, and that is something gained. It has too often been the practice to take a small plant running a few lights, arc or incandescent, and then make the comparison with a gas plant supplying hundreds of thousands of burners. In most businesses such a comparison would be regarded as absurd, but we could mention recent instances in which this has been done to the disadvantage of the electric light. Of course such fallacies, prejudices and "tests" are lived down, simply because every step in the art or in the industry is in the direction of higher economy and greater profit. It is not many years since the cost of elaborate experiments had to be figured into the expense of the apparatus purchased, but now the man who, seeing the demand and the value that electrical franchises are to have, puts his money into an electric light plant, buys very close to a manufacturing price, and is in reality the possessor of the most perfect machinery for producing light and distributing power that is known to modern science and civilization. One might even assert with truth that it is now the gasman's turn to pay for a few experiments. This, indeed, was stated in so many words in one of the newspapers this week with regard to New York. "I do not see," was the remark, "how gas can be cheapened so long as it is manufactured by the plants owned at present by the gas companies of this city. It is only, in my opinion, with the introduction of new machinery that the desired end can be accomplished.' There is force in this language. The speaker might have gone further and said that the new apparatus would necessarily be of the kind to turn out gas less for lighting purposes and more for fuel, leaving to electricity the work of illuminating houses, whence naked lights are forever banished, and streets where every captain of police welcomes it as his best ally in maintaining public safety and order.

THE proper operation of electric lighting installations requries, as a rule, the maintenance of fixed conditions of some sort, whether of current or of electromotive force; and incandescent lighting, especially, demands the highest degree of permanence in the latter condition for economy of operation. For while a variation of only 5 per cent. in the strength of an arc light current would have scarcely any effect on the system, a similar variation on an incandescent circuit would, in one direction, result in considerable diminution in the brilliancy of the lamps, and in the other would entail their rapid destruction. Hence it becomes necessary to provide instruments which shall show the conditions existent, so that any variation from the standard may be at once corrected. As is pointed out in another column, the instruments designed to insure fixed conditions of working are based upon two principles, and in nearly all cases both involve a variable factor. In the case of direct reading instruments their operation, with few exceptions, depends upon the action of a force, which may be that of a magnet, spring or solenoid influencing a core. Where the zero method of indication is employed, the constancy of a resistance or of a standard cell is depended upon for contancy of indication. Thus, while both methods involve uncertainties, the choice seems to rest with that method which will afford the readiest means of re-establishing the correct reading of an instrument in case of its becoming inaccurate. It was upon consideration of this point, among others, that the Edison Company adopted a system of indicating instruments which could be compared directly with a standard of resistance, the ohm, and a standard of E. M. F., such as the Latimer Clark cell. The zero method of indication has been objected to by some on the score that it does not furnish at a glance the true value of the force measured, but this is met by the argument that in most cases some fixed condition is required to be maintained, and that an *indicator*, as distinguished from a *measurer*, is quite sufficient in the hands of the attendant. Another point urged by the adherents of the zero method is the fact that a small variation from the fixed condition in the case of direct reading instruments causes only a small deflection of the pointer of the instrument while, on the other hand, a small variation with the zero method may be arranged to give a large deflection on a suitable galvanometer. The eye of an attendant is thus more easily attracted by a variation in the latter case. Both methods undoubtedly have their own peculiar merits, but the best results would seem to be obtainable where both are applied to the same circuit, so that one may be an ever ready check on the other.

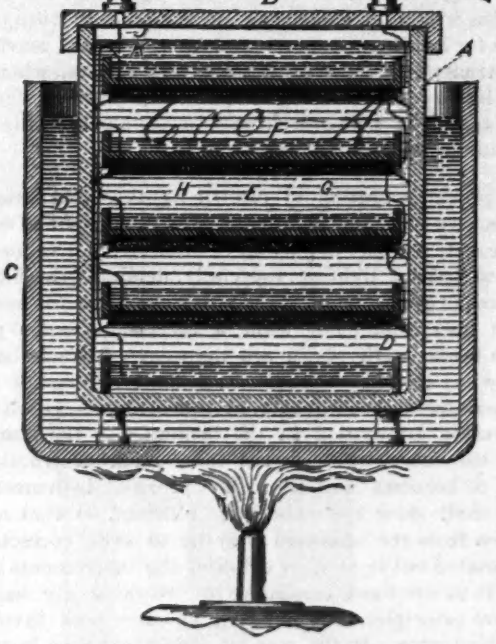
A New Form of the Case Heat Cell.

In our issue of July 17, 1886, we described a galvanic cell invented by Mr. Willard E. Case, of Auburn, N. Y., in which heat applied to the cell was converted into electrical energy. In this cell, it will be remembered, there was employed an electrode of tin, a liquid consisting of a chromic-chloride solution, and an electrode of carbon. The cell yields substantially no current when at normal temperature, but when heat is applied a current is set up, the strength of which augments until a certain maximum temperature below that of boiling water is reached. Chlorine liberated from the liquid then energetically attacks the tin and leaves the chromium forming stannous chloride. On the cooling of the cell, however, to a lower temperature, the chlorine releases the tin, again combines with the chromium, and the tin is precipitated in a fine powder. The tin element may be originally introduced as a solid mass of metal or as a powder; but, as appears from the foregoing, it ultimately reaches a pulverized state.

Later experiment has shown Mr. Case, however, that it is very advantageous to provide a means whereby all the particles of tin normally not cohesive will be electrically connected by a conducting material which will not be attacked by the liquid in the cell. The mass of pulverized metal is thus rendered more homogeneous as a whole, and more uniformly acted upon by the liquid. Such a material is mercury, which is placed so that it will receive and collect the precipitated tin particles and amalgamate them together. This it does as fast as it receives the particles, by reason of its own mobility. So also it amalgamates the tin in the common sense of the term; that is, it prevents local action between the tin particles.

The accompanying illustration shows the new disposition of the cell. It consists of an outer vessel *C*, which holds water that can be heated as shown. Within the water is placed the cell proper *A*, within which are formed the lugs *D* that support the trays *E*. These trays are made of insulating material, such as glass or rubber.

Each tray contains mercury *F*, and to the lower portion of each is secured a plate of carbon *G* which is covered by a



NEW FORM OF CASE HEAT BATTERY.

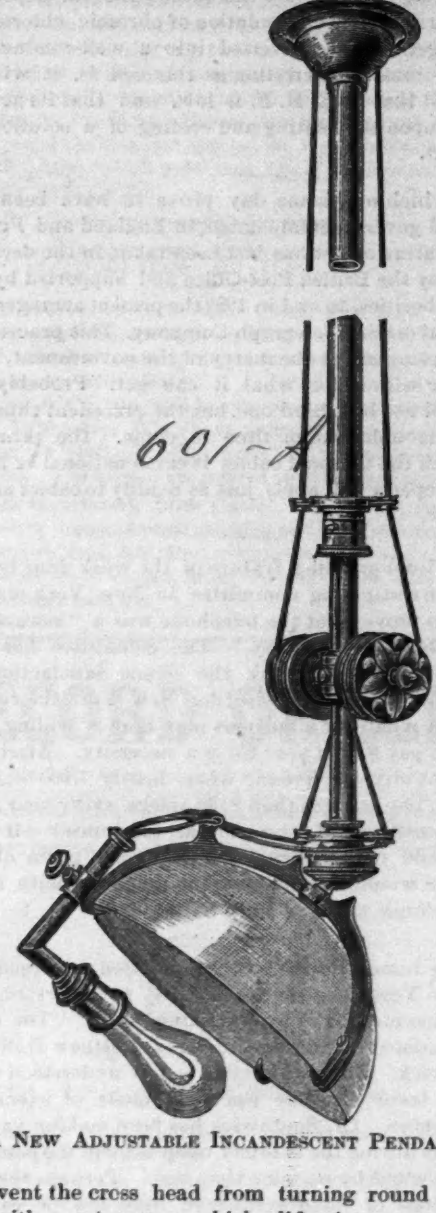
partition of porous insulating material *H*, in order to prevent possible contact of the precipitated metal and the carbon.

The vessel *A* contains chromic-chloride liquid, which circulates freely around the trays. The several carbons are electrically connected by the wire *I*, which is covered with insulating material to prevent contact with the liquid, and joined to the binding-post 2. The mercury in the several trays is also connected by the wire *J* and branches *K*, also insulated, to the binding-post 1. Each carbon plate above the several trays forms a couple with the tin amalgam in the tray below.

An Adjustable Electric Light Pendant.

The accompanying illustration shows an adjustable pendant for use with incandescent lamps, which has been designed by Messrs. Sayers & Sturges, the principal novelty consisting in the manner in which the slack of the leads or flexible cord is taken up when the lamp is raised. As will be seen from the illustration, which is taken from *Industries*, there is an outer and inner tube, the latter sliding within the former, and being provided at its lower end with a ball and socket joint, by means of which the frame supporting the shade and lamp can be turned in any desired direction. In addition to this adjustment, the lamp itself can be set further into, or out of, the shade, and can also be turned round on the right angle stem of the holder, and fixed by a thumb-screw, so that the fitting provides for any possible adjustment, both as regards the height of the lamp and the direction in which the rays are thrown.

To take up the slack in the leads, the inner sliding tube is provided with a cross head having a pulley with a double groove on either side for the reception of the flexible cord. The upper and lower portions of the lead are wound in opposite directions, one in each groove, so that if the lamp is pulled down both portions uncoil and the cross head moves downward half the distance of the lamp. When the lamp is raised, the leads are coiled up again, a spring within the pulleys tending to keep the leads always taut.



A NEW ADJUSTABLE INCANDESCENT PENDANT.

To prevent the cross head from turning round it is provided with a set screw, which slides in a groove in the inner tube. Where there would be danger of the leads chafing against metal parts, they are protected by small wooden insulators, and the whole design is very light and neat. One of the three arms carrying the shade has a hinged hook, while the top of the shade rests against a spiral spring below the ball and socket joint.

The Jehl and Rupp Continuous Current Transformers.

Among the recent transformer apparatus brought out abroad is the continuous current transformer of Jehl and Rupp. In this apparatus, shown in Fig. 1, two laminated iron rings are supported on a spindle, the inner one acting as an armature to complete the magnetic circuit.

Two ordinary Gramme collectors are also fixed on the same spindle, one for each circuit, the bars of which are connected to the distribution commutator, the object being to send a pulsating current through the primary and to collect the induced current from the secondary.

By the action of the apparatus the fixed outer ring is

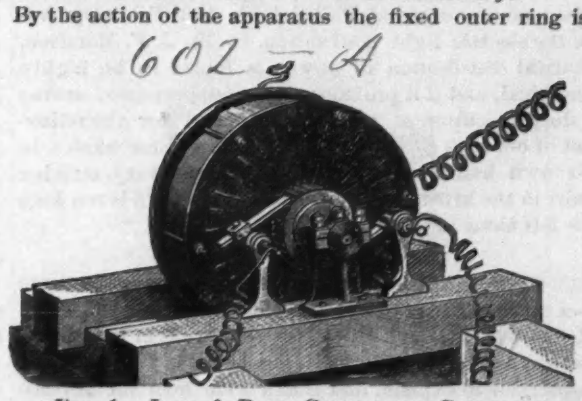


FIG. 1.—JEHL & RUPP CONTINUOUS CURRENT TRANSFORMER.

successively polarized at diametrically opposite points, advancing in jerks by the angular distance corresponding to a section of the winding. A pulsating magnetic flux is thus generated in opposite directions through the fixed ring, the circuit being always completed by the armature, which is in synchronous motion with these pulsations. Under these circumstances an electric current of like pulsating character is generated in the secondary circuit, but which, by means of the commuting arrangement above described, leaves the large brushes on the Gramme collector in the same state of continuity as the primary. It is evident that a motor is required to rotate the inner ring, and this would seem to constitute a drawback to the operation of the system.

Mr. Clarence L. Healy on Stock Printers.

At the last meeting of the New York Electrical Society, held on the 14th of December, Mr. Clarence L. Healy, the electrician of the Commercial Telegram Company of this city, gave an interesting and instructive history of the progress in printing telegraphs and stock quotation printers. Beginning with the intrument designed by Law, Mr. Healy pointed out with the aid of the lantern the various obstacles that were met with in the operation of these instruments, and the remedies that were applied to overcome these difficulties, the principal among them being the unisoning of the various printers. In the course of his lecture Mr. Healy described the Callahan printer, the Smith, Edison, Field, Scott and a number of others. Mr. Healy drew attention to the fact that the speed of printers had been brought to such a rate that even during a brisk market the operator on the printing circuit could keep up with the reports sent in from the Stock Exchange, and was rarely more than one or two quotations behind the market; hence an increase of speed would add little to the value of an instrument at the present day, and it is in the simplification of details that improvement must be looked for. Much of this speed depends of course on the skill of the operator on the keyboard, and not a little on the arrangement of the letters on the type-wheels. During the discussion Mr. A. C. Fowler drew attention to a printer recently invented by Mr. C. J. Wiley, in which the quotations, instead of being printed on two lines on a continuous narrow tape, were printed side by side in parallel columns on a wide sheet of paper. Mr. Fowler showed that by this means a large saving in time could be effected, as it would probably do away with one-half the characters now required, and it would at the same time permit one to inspect at a single glance the exact quotation required without hunting over the yards of tape to find the one sought for.

Electricity as a Type-Setter.

A. S. Capehart, proof-reader on the Minneapolis *Tribune*, and S. G. Goodson have perfected a machine which is "destined to revolutionize the whole business of printing."

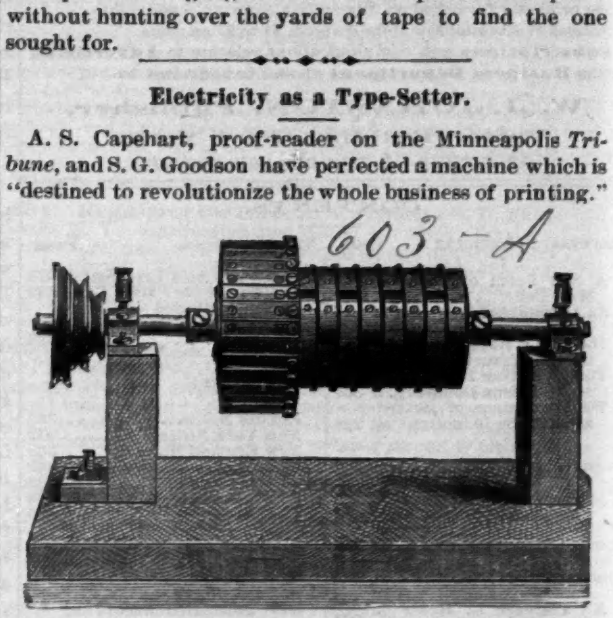


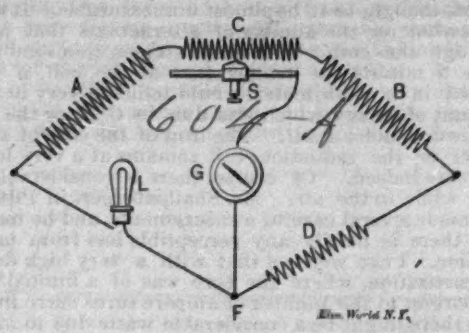
FIG. 2.—JEHL & RUFF CONTINUOUS CURRENT TRANSFORMER.

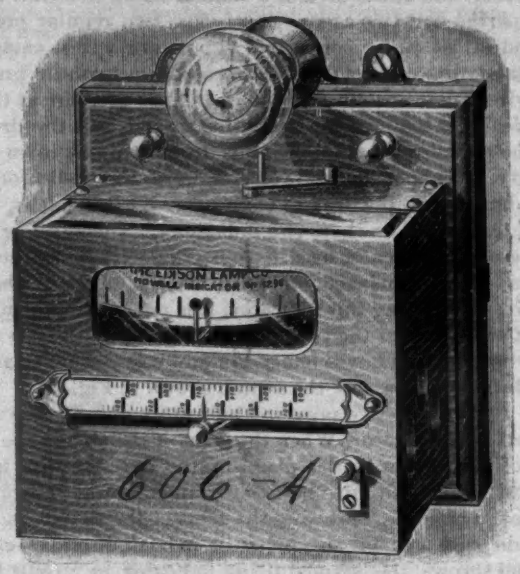
The two conceived the idea that electricity might be employed to do the work, and finally submitted their plans to C. L. Redfield, a well-known mechanical engineer, editor of *Wood and Iron*. He made some valuable suggestions in the line of rendering the idea practicable, and made the drawings. The three at once set to work on having the models constructed. These worked well, and recently a machine was completed. It did the work perfectly and at the astonishing rate of 200 impressions per minute, or 5,000 "ems" an hour, against the 1,100 ems the average compositor can now set. The success of the machine was such that a number of local capitalists were at once interested in it, and the Minneapolis Electro-Matrix Company has been incorporated, with $1,000,000 capital. The machine is not properly a type-setting machine, for it uses no type at all, but a matrix-making machine. The letters are punched in a strip of cardboard, the width of a column, from which a stereotype is made in exactly the same manner as stereotypes are now made from pasteboard matrixes. The work of punching the dies in, of feeding in the cardboard, and of preparing it for the next stroke, is all done by electricity. The operator simply has to push the die-plate to the right place and strike the key. The act of pressing the key down makes an electrical connection which throws the matrix the proper distance for the letter to be printed, and at the same time throws down a hammer upon the die, driving it through the hole into the matrix. The operator's attention is confined strictly to pressing the key into the proper hole, and throwing the spaces. When the end of the line is reached, a touch upon another key returns the matrix to the beginning of the line, when a touch upon a third key moves the matrix for either an ordinary or leaded line, as may be desired. One man operating the electro-matrix machine will supplant at least five men setting type.

The Indicating Instruments of the Edison Company.

I.

Incandescent lighting had hardly become an accomplished fact before it was made apparent that in order to operate not only with economy but also with satisfaction to the public, the circuits required constant watching. The economy alluded to refers principally to the life of the lamp, and this is one of the most important items in central station as well as in isolated work. We can best form an idea of the importance of keeping a uniform potential at the various points in a system of distribution, by considering the fact that a lamp running at but a few volts above its normal capacity will have its life shortened very much. Thus a lamp designed to run for 1,000 hours at 107 volts pressure will only last 500 hours at 110 volts; that is, at an excess of only 3 volts. But while this is an item relating to the economy of the system, satisfactory lighting



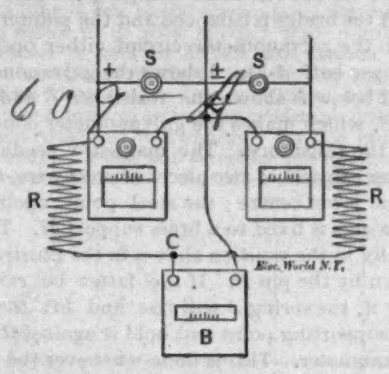


galvanometer gives no deflection; but with a properly constructed galvanometer a small change in the value of the quantity being measured will produce a large movement of the galvanometer pointer. This enables one to read quantities closely, and to readily see small changes in them. Instruments of this class are specially suitable for engine-room indicators.

For incandescent lighting it is necessary to maintain a

ments embody a variety of principles in their operation, but it will be noted from the descriptions that follow that nearly all are designed on the zero method of indication. By adopting this principle, the use of springs, electro-magnets, or permanent magnets as acting forces is avoided. The permanent magnet employed in the instruments is in the shape of a needle, which indicates the true reading only when in a neutral position that is, when it is not acted upon, or is in equilibrium. These instruments include for the most part apparatus for measuring the potential or pressure carried on the circuit, as this is evidently the principal point to be considered in the operation of incandescent lights. We propose to describe these various instruments, and shall begin with the standard pressure indicator.

This instrument is shown in perspective in the engraving, Fig. 1, and by its means all variations in pressure are immediately indicated.



FIGS. 2, 1 AND 7.—INDICATING INSTRUMENTS OF THE EDISON ELECTRIC LIGHT COMPANY.

requires the lamps to be always of uniform brilliancy, no matter what the load on the circuit. To accomplish all this it is necessary to employ instruments which shall in the first place indicate the exact condition of the circuits, and in the second place give warning whenever these conditions are violated.

Electrical measuring instruments are of two kinds: 1. Direct reading instruments, or those in which a pointer moves over a scale and, by its position on the same when at rest, shows the value of the quantity being measured. The tangent galvanometer or the Ayrton & Perry voltmeter are examples of instruments of this class. 2. Zero instruments, or those in which the value of the quantity measured is shown by the arrangement of the essential parts of the instrument, *so that a galvanometer connected with the instrument shows no deflection.* Wheatstone's bridge and the potentiometer are examples of instruments of this class. Where great accuracy is required in standardizing instruments it is universally done by reference to zero instruments. Every good laboratory is now provided with reliable standards of resistance and electromotive force; current standards are derived from these standards, so that all measurements refer back to the standards of resistance and E. M. F. All resistances are made from standards by means of a Wheatstone bridge, which is a zero instrument. The best standard of electromotive force is a Latimer Clark cell. The Daniell cell under known conditions is also a good standard. The working potential galvanometers in laboratories are standardized by reference to a potentiometer in which one of the above mentioned cells is used. A potentiometer is a zero instrument; so that all electrical measuring instruments are standardized by reference to zero instruments.

Instruments of the first class enable one to read any quantity within the range of the instrument, without

constant pressure on the circuit. In any plant the pressure is fixed by the lamps used, and it is necessary to keep the pressure invariably at this point, and no other pressure concerns the attendant in the least. The engineer

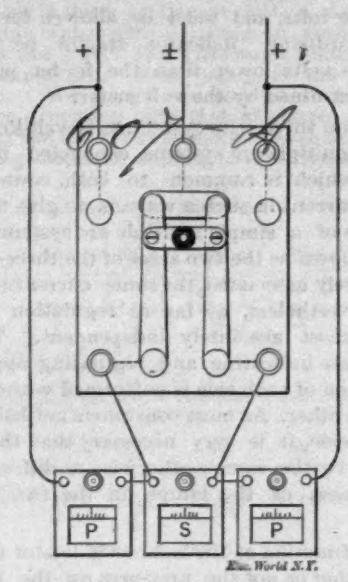
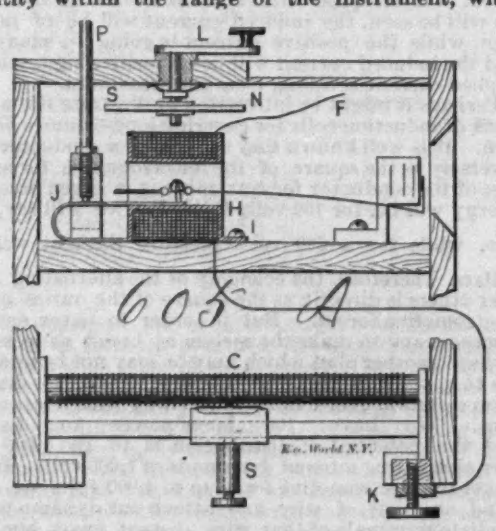


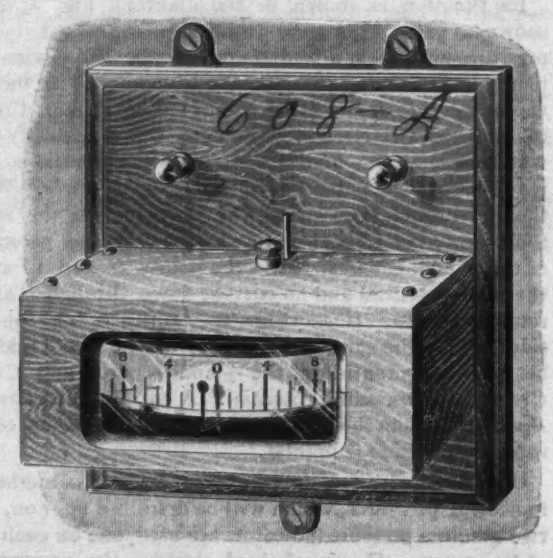
FIG. 5.

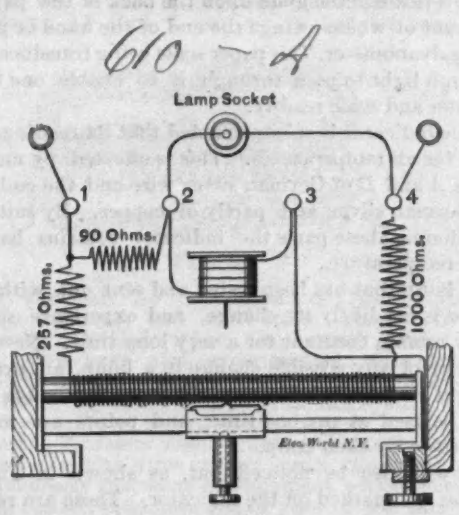
should have a pressure indicator which enables him to see readily *from a distance* whether or not the pressure is right. A zero instrument enables him to do this, as when the pressure is right the pointer is at zero, in the

The principle upon which the action of the indicator depends is the great variation in the resistance of a carbon filament due to change of temperature. The circuit to be measured is made to act upon the carbon filament, sending a current through it, and the amount of current which flows through the filament is determined by the pressure on the circuit and varies with this pressure. The temperature of the filament varies with the current, and so, also, does its resistance. Hence, by measuring the resistance of the filament at any time, we measure indirectly the pressure or potential acting upon it. The indicator is simply a Wheatstone bridge arrangement, by which the resistance of the filament is measured when a current is flowing through it. Although in reality the resistance of the carbon filament is measured, the marks upon the scale give the volts or pressure necessary to bring the carbon to that resistance, and hence such a scale gives a direct measure of the pressure of the circuit.

The diagram, Fig. 2, shows the essential details of the indicator. Here L represents a high resistance lamp, giving the necessary high carbon resistance, and D is a coil of wire heavy enough to carry the lamp current without heating too much. These two resistances form one arm of the bridge. The other arm is made up of three wire resistances, A, C and B, and the galvanometer is connected between the point F and the frame upon which the sliding contact S slides. This enables the galvanometer contact to be made at any point of the resistance C. If A, plus that part of C on the left hand side of the galvanometer contact, be represented by A'; and B, plus the part of C on the right hand side of the galvanometer contact, be represented by B', then, when the bridge is balanced and no current flows through G, we have $A' D = B' L$. G is a







FIGS. 3, 6, AND 4.—INDICATING INSTRUMENTS OF THE EDISON ELECTRIC LIGHT COMPANY.

making any adjustment, by simply looking at the scale or dial and observing the position of the pointer. For laboratory work, or where one is called upon to measure large and small quantities, or variable quantities, these instruments possess decided advantages. But as the length of the scale represents the entire motion of the pointer for the range of values the instrument can measure, it follows that if the range is large the motion of the pointer for a unit change in value must be small; and hence to read these instruments accurately it is necessary to look closely at the dial. With instruments of the second class much more time is required to measure a quantity, as the instrument has to be adjusted until the middle of the scale, and a change of one volt may deflect the pointer half an inch or an inch from zero if desirable. Such small changes in voltage may be easily seen from a distance and the pressure be kept right.

The pressure indicators used by the Edison Company are all zero instruments; they can be adjusted for the pressure used in any plant, and the divisions on the scale in front of which the pointer swings are ¼ inch apart; and to deflect the pointer over one of these divisions requires a change of two volts in the pressure on the line.

The Edison Company have for some time been using a number of instruments for this purpose, built at the Edison lamp works at Harrison, N. J. These instru-

simple galvanometer which shows the direction and relative amount of the current flowing through it; when the hand is on zero no current is flowing in G.

Now, if the sliding contact be in the centre of resistance C and a suitable lamp be in L, on sending a current through the indicator and gradually increasing it the resistance of the filament becomes less and less, until, when the desired pressure is acting upon the indicator, we have $A'D = B'L$. No current flows in G, and the pointer remains on zero with the circuit either made or broken. This position of the sliding contact is marked to indicate what this pressure is, and if at any time the contact be placed at this point and the pressure made such that there

is no current in G, it is evident that the indicator shows the same pressure as that employed when it was adjusted at that point. The indicator being thus balanced, if the pressure be increased the pointer will move to one side of zero; if it be decreased it will move to the other side. If now the sliding contact be moved to some other point it will alter the values A' and B' and the pressure will have to be changed until the resistance of L is changed enough to make $A'D = B'L$ again. This position of S corresponding with the new pressure can be marked, and in this way can be found the pressures that will balance the bridge with the contact S in any position on the coil C. Thus the scale can be marked for a range of volts. The pressure of the circuit can then be set at any point that is on the scale of the indicator by simply moving the contact S to that point on the scale and changing the pressure on the line until the bridge is balanced and the pointer remains at zero with the galvanometer circuit either open or closed.

The upper half of Fig. 3 shows the galvanometer in section, and below is shown the resistance C and the sliding contact S, which makes the galvanometer contact at any point of the resistance. The magnetic needle in the galvanometer consists of two pieces of steel wire, one on each side of the jewel centre; the steel point upon which the needle swings is fixed to a brass support H. The spring J is normally in the position shown in the illustration, being held down by the pin P. If the latter be raised by unscrewing it, the spring J will rise and lift the needle off its steel supporting point and hold it against the frame of the galvanometer. This is done whenever the indicator is carried about or handled; otherwise the steel point might become dull or be broken. The directing magnet NS overcomes the earth's magnetism, and makes a magnetic field for the galvanometer, which enables the pointer to be brought to zero whatever the position of the indicator; the directing magnet may be moved one way or the other by the lever L. The galvanometer circuit runs from F, Fig. 3, through the galvanometer, through the switch to the metal frame on which the sliding contact travels, and through the sliding contact to the point of contact on resistance C. The switch is a simple screw connecting the brass block K, to which the galvanometer wire is fastened, to the metal frame carrying the sliding contact. When the screw is withdrawn one or two turns, so that it no longer touches the frame of the slider, the galvanometer circuit is broken. The upper part of the box which contains the galvanometer is separated from the lower part, which contains the resistances, by a wooden partition, to which the galvanometer and scale are fastened.

Fig. 4 shows the connections of the indicator as they exist in the instrument, the coils, however, being shown separately. These connections, four in number, are shown in the order in which they exist in the indicator.

The resistances A, B and D are wound upon one wooden spool which is placed on the lower part of the box under the partition. This space is ventilated through the sides and bottom, front and back of the box; the spool is also made so that the wire upon it is well ventilated. The resistance C and the frame carrying it and the sliding contact are placed in the lower part of the box. The handle by which the sliding contact is moved projects out through a slot in the front of the box, so that it can be easily moved.

The lamp forming the high carbon resistance is screwed into a socket on the base of the indicator just above the box holding the galvanometer and resistances. Half of the top of this box is of glass, so that the light from the lamp shines through the glass upon the back of the paper scale, in front of which swings the end of the hand or pointer of the galvanometer. This paper scale being translucent allows enough light to pass through it to enable one to see the pointer and scale readily.

The indicator is so constructed that its readings are correct for all temperatures. This is effected by making the coils A and D of German silver wire and the coil B partly of German silver and partly of copper. By suitably proportioning these parts the indicator remains balanced at any temperature.

A lamp that has been tested and sent out with an indicator is not likely to change, and experience shows that they remain constant for a very long time. Nevertheless, to correct any possible change in a lamp, an extra lamp is sent with each indicator. Of these two lamps only one can be used at any one time, and points are marked on the scale for each lamp.

It will also be noticed that, as shown in Fig. 1, two scales are marked on the indicator. These are respectively drawn in red and black ink, and the lamps sent with the indicator are marked in red and black to correspond. The object of this is to afford a means of checking the accuracy of the readings, by employing one lamp solely for the purposes of comparison, which is used but seldom, and whose resistance, therefore, does not vary. The other lamp is employed continuously, and any variation in its resistance is shown when compared with the standard lamp.

In isolated plants the indicator is connected either to a part of the circuit where lamps are connected, and if possible to a circuit where lamps are burning most of the time; or to the centre of distribution, if there is only one such centre. In the latter case, it is necessary to set the indicator for a pressure higher than the lamp pressure by the loss from the centre of distribution to the lamps. Thus, if in a 108 volt plant the loss from the centre of distribution to the lamps is 3 per cent., the indicator is set for 106 instead of 108 volts, since the pressure indicated is that at the indicator itself.

In central stations using comparative indicators, three pressure indicators are employed. Two of these are connected to the pressure wires from the end of the standard feeder, and one is used as a standardizing indicator to adjust the first two at any time. The two regular pressure indicators, being connected to pressure wires, cannot be standardized properly before sending out, as the pressure wires are in circuit with them, and the pressure at the indicator is the pressure at the feeder end, less the drop on the pressure wires; and as this drop is an unknown quantity, it cannot be allowed for until the indicators are connected in the drop to be measured. No scale is, therefore, marked on these two indicators. The third or standardizing indicator used in connection with central stations has a scale marked on it, covering a range of about 15 volts. In using this indicator, it is put in circuit in place of either one of the two regular pressure indicators to tell whether these have changed in any way. This is accomplished by means of the switch shown in Fig. 7.

P P are the two pressure indicators and S is the standardizing indicator. When the arms of the switch are in the position shown in the diagram, the two pressure indicators are in circuit, but the standardizing indicator is not in circuit. Throwing the arms of the switch on either side cuts one of the pressure indicators out of circuit, and throws the standardizing indicator in circuit in its place. When used in this way the reading on the standardizing indicator should be less than the pressure it is desired to maintain at the feeder ends by the drop in the pressure wires. If these pressure wires are copper wires (about No. 12) this drop is negligible, and the standardizing indicator should balance at the feeder end pressure. If, however, the pressure wires are iron, the drop is often four or five volts, and must be allowed for; in this case the standardizing indicator should be balanced at four or five volts lower than the feeder pressure. This drop is determined by the volt meter.

The Edison three-wire system, as is well-known, is made up of two multiple arc systems connected in series, with the wire, which is common to both, connected to the source of current in such a way as to give to each all the advantages of a simple multiple arc system. These two systems, known as the two sides of the three-wire system, are intimately associated, the same current being used in both. Nevertheless, as far as regulation is concerned, they are almost absolutely independent. The two sides have separate indicating and regulating apparatus, and the regulaton of each side is performed without any reference to the other. As most consumers get half their lamps from each side, it is very necessary that the pressure on both sides be the same; otherwise a difference between the brightness of the lamps on the two sides will be noticed.

It is the function of the balance indicator to show at all times whether or not the pressures on the two sides are the same.

In connection with the pressure indicator there is employed the galvanometer, shown in Fig. 6, which in the three-wire system acts as a balance indicator and thus indicates whether the pressure on both sides of the system is the same.

Its function is shown in the diagram, Fig. 5, which shows a pair of pressure indicators connected to the pressure wires from a feeder end on the three-wire system. R R are two equal high resistances and B the galvanometer; R, R and B are connected as shown directly to the three-wire circuit. The point C is electrically midway between the + and — wires, and its potential is halfway between the potentials of the + and — wires. When the pressures on the two sides at this point are the same, the potential of C' is also midway between the potentials of the + and — wires. Then the points C and C' are at the same potential and no current flows through B and it remains at zero. If, however, the pressures on the two sides are not the same, then the potential C' is not midway between the potentials of the + and — wires and C and C' are not at the same potential. A current then flows in B which deflects the needle and the direction of deflection shows which side is highest.

On a three-wire system using the comparative method of indicating pressures, which will be described later on, only two absolute pressure indicators are used, one on each side of the system. If one of these changes, the pressure on all that side changes, as the comparative indicators simply copy the pressure kept by this indicator. If, however, there is a balance indicator connected around the two indicators, any change in either one of them is immediately shown and can be remedied. In the diagram S S indicates lamp sockets. If at any time it is necessary to take down one of the two pressure indicators, the lamp from this indicator can be screwed in the socket above the indicator taken out. The pressures can then be regulated by one pressure indicator and the balance indicator, the one pressure indicator holding the desired pressure on one side, and the balance indicator showing when it is the same on the other side. The galvanometer used for the balance indicator is also used in throwing dynamos in circuit.

The Phenomena of Retardation In the Induction Coil.

We give below a report of the discussion of Mr. W. Stanley, Jr.'s, paper on the above subject, at the meeting of the American Institute of Electrical Engineers, on Dec. 6:

Mr. WOLCOTT: I would like to ask Mr. Stanley if he has ever observed an effect in the reversing of magnetization of the cores other than Foucault currents. That is, a sort of magnetic friction due to the mere reversal of polarity, independent of any induced current requiring an expenditure of energy. I know that some years ago a French physicist experimented with alternating currents, using a copper core in one case and an iron core in another. Had the heating effect been due to the Foucault currents, the copper would have become much hotter than the iron, while, in fact, it did not get hot at all, but the iron got hot. I would like to know how much effect that has in practice on the alternating system.

Mr. STANLEY: In measuring the waste in an induction coil we have found a very slight unaccountable waste, so slight, though, as to be almost unmeasurable. It depends somewhat on the number of alternations that are sent through the coil. With about sixteen thousand alternations a minute the temperature of the coil, if it were placed in a calorimeter, would indicate very nearly the amount of energy which was due to C^2R, or the heating of the conductor itself. The iron of the core of the converter or the induction coil remains at a very low temperature indeed. Of course, there is considerable radiation while in the air. Mr. Shallenberger, in Pittsburgh, has made several careful measurements, and he has found that there is hardly any perceptible loss from magnetic friction. I can well see that with a very high degree of magnetization, where the core was of a limited area, in proportion to the number of ampère turns surrounding it, that there might be a considerable waste due to magnetic friction or magnetic saturation, but with the induction coil, as made for the distribution of electricity for lighting purposes, this is very small. I cannot tell you the exact loss, but it is very small.

Mr. HOWSON called attention to the fact that a distinction had to be made between the true alternating current and the reversed or interrupted direct current.

Mr. STANLEY remarked that for the purposes of distribution by means of transformers the interrupted or reversed direct current was of very little value.

Mr. STANLEY: With your permission, I will endeavor to sift out this subject a little bit more. As I understand it, the effect of joining the magnetic circuit around the primary and secondary induction coil is practically to reduce the wire, if I remember correctly, to about one-sixth. In experimenting with coils, to begin with, I took Faraday's ring and wound a coil on either side. The best coil I have ever seen consisted of a bundle of perfectly straight wires on which was threaded a lot of iron washers. This has the highest counter induction per unit of length of any coil I have ever seen. In the Westinghouse Company's system we get about two volts per foot of wire. This coil gave, if I remember correctly, about a volt to four inches. But it was impracticable to construct, as you could not make them fast enough. As I understand it the curves of electromotive force induced from an alternating current are these, Fig. 1. A, B, C, D, E, is a complete period of the curve of the primary or applied electromotive force. Now the induced electromotive force will be maximum at the time when the inductive effect of this primary current is a maximum; and the inductive effect of the primary current is a maximum when it changes from zero to any larger value. Consequently, the electromotive force of the induced current shown in the lower curve, Fig. 1, will be a maximum at this time; and it will be a minimum when the inductive effect of the primary is a maximum, and that will be when the rate of change of the primary is the least, viz., at the crest of the primary wave B and D, we find that the same values of applied and counter electromotive force are just one-fourth of the whole period of phase of the current. That is with an alternating current. In the direct current we never can have as great an electromotive force induced in the secondary circuit because the primary circuit never passes the zero line. The curve of induced electromotive force in the case of a broken direct or interrupted direct current I think is this, Fig. 2. As will be seen, the induced current will be of negative sign, while the positive current is going to maximum; and the induced current will be of positive sign, while the applied current is falling from the maximum.

Perhaps it might be interesting to illustrate the applications of induction coils for covering long-distance distribution. It is well known that the cost of a conductor varies inversely as the square of the electromotive force. The cost of the conductor for transmitting a given amount of energy will be, for 100 volts E. M. F., we will say, x dollars, while for a 200 volts pressure the cost will be $\frac{x}{4}$ dollars. Therefore, the economy of the alternating system over others is directly as the square of the ratios of their electromotive forces. But in order to cover enormous distances and to make the system as broad as possible, I devised another plan which may or may not be new. We are to apply it in Berkshire County, Mass., to distribute from a station over 6 miles of territory with a loss of 2 per cent. We have 100 horse-power to distribute and the potential of distribution is to be 4,000 volts. Our alternating current dynamo is of 1,000 volts. In order to get the electromotive force up to 4,000 volts we simply wind one coil of wire and attach our dynamo to intermediate terminals of that wire, distant apart one-fourth of the entire length, as shown in Fig. 3. That is, the length included between the terminals is one-fourth of the whole length of wire wound on the coil. There is no secondary circuit whatever. Of course there is an induced electromotive force upon every turn of wire on that core of so many volts per turn. We apply our electromotive force of 1,000 volts at those points in order to get 4,000 volts between the outside terminals. When we carry our current at this enormous potential over to the place where we wish to distribute we simply attach another self-induction coil similar to the first. On one-fourth of its entire length we tap out another circuit. That reduces the potential from four thousand volts to one thousand volts again. The maximum efficiency of an auto-converter, or converter of one coil, evidently is found in the case where the ratio of reduction is from 1 to 2, or 2 to 1. If you have it in the ratio of 1 to 4, or 1 to 6, the saving is not nearly as great.

Mr. PRESCOTT: I was in the station that Mr. Stanley

speaks about in the Berkshire hills a few days ago, and noticed that they had for the generators one omnibus wire running around the station, such as they use in the Edison station. But this omnibus wire was split in two, and each generator worked into its own circuit. I asked the attendant why the omnibus wire was not connected across, and he said that when they connected it across they were likely to burn out their armatures. I would like to ask Mr. Stanley if that is so?

Mr. STANLEY: That is so through an oversight in the construction of the dynamos in the early stage of the business. We all have to learn some things, and the reason why it has been difficult to multiple arc alternating dynamos is that the phases have not been exactly the same. We made our dynamo pole pieces of cast iron. Those cast-iron pole pieces did not measure to a thousandth of an inch the same in width, and consequently the two phases of current, which ought to have coincided, did not coincide exactly, simply because of faulty construction. By tooling off and cutting the width of the pole pieces to an exact measurement, there is not the slightest difficulty in multiple arcing two, three or four alternating dynamos. I think a new feature in alternating currents, perhaps not well known to every one here, is the remarkable self regulation of the alternating current machine. I cannot speak of it fully because I have had very little to do with it. Another man is responsible for the beautiful work he has succeeded in getting. In Pittsburgh, a few days ago, I saw a 2,500-light dynamo run by a 250 horse-power engine, and 2,150 lights thrown off by a single switch. The rise in electromotive force was one volt. I submit, that in the present state of the art, it is impossible to construct a direct current machine which shall have anything like the self-regulation these alternating machines exhibit. The resistance at the commutator of a direct current machine would cause a greater variation of potential than was manifested in this machine I speak of. In the induction system we start out with an alternating current machine, in which we pretend to have at least a maximum loss of two volts in electromotive force in the dynamo with the proper regulation necessary to any machine. Towns are wired, at least I know of two pole lines which are wired, for one per cent. loss of electromotive force, distributing electricity generally over an area of about a mile radius. The actual loss in the mains is one per cent. In the induction coil, at full load, there is another loss of two per cent.

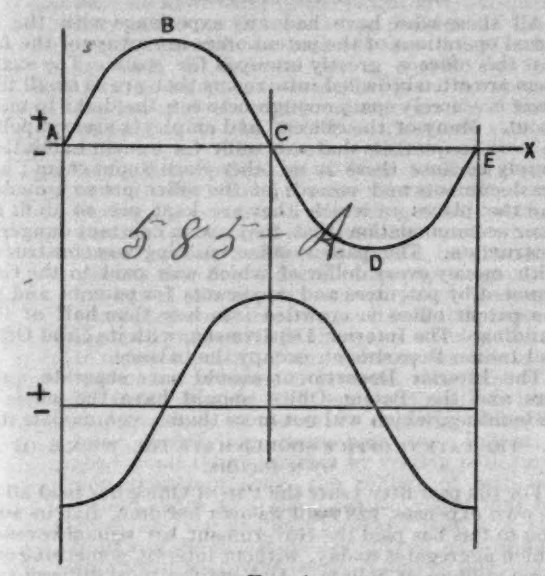


FIG. 1.

Mr. MAILLOUX: I was expecting that somebody would refer to one of the features mentioned by Mr. Stanley this evening, which is to me one of the most interesting, if not, as it appears to me, of most interest from the theoretical as well as from the practical standpoint, inasmuch as it leads to a wide scope of applications. It is that system in which four lamps, *a*, *b*, *c*, *d*, were connected across the terminals of a constant potential alternating circuit, and in which the difference of potential for a particular lamp cut out was taken up by the self induction coil as *e*, Figs. 4 and 5. Now, I would like to ask Mr. Stanley whether the object of using that induction coil was merely to balance the other lamps, or whether it was expected that any energy would be saved by its use; in other words, whether the two lamps running with the circuit continued through the self induction coil would require less current than would the four lamps.

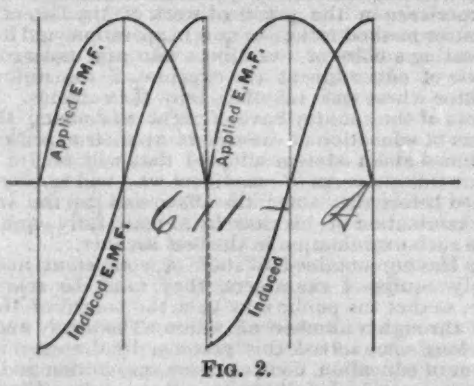


FIG. 2.

Mr. STANLEY: The connection of the lamps in series in that way was for a street-lighting system. In order to distribute lamps economically for street lighting purposes the plan adopted by Mr. Shallenberger was brought out. The shunted coil on the extinguishment of any one lamp prevents the rest of the lamps going out. For instance, there would be twenty lamps attached to a 1,000-volt circuit, each lamp of 50 volts. Now all those twenty lamps may go out, or nineteen go out and the remaining lamp would be at approximate candle power; and yet the sum of the separate electromotive forces, measured by a voltmeter around the lamps and coils, is far in excess of the electromotive force that is applied to the outside terminals of the series.

For instance, there are four lamps connected in series. There was a lamp connected at *a*. That lamp is extinguished and in place of it there is a self induction coil *e*, Fig. 5. This series is connected to a circuit whose voltage is two hundred volts; a voltmeter connected to each one of these lamps will show for the lamps *b*, *c*, *d*, 50 volts each, and for the self induction coil, 100 volts. Now the sum of the interior electromotive forces here is two hundred and fifty volts. The same voltmeter will show an electromotive force of two hundred volts on the outside terminals. That is, the sum of the interior electromotive forces is greater than the applied electromotive force. I think that can only be explained by the retardation of the current producing the average electromotive force.

Mr. PRESCOTT: In regard to the point that Mr. Stanley kindly replied to a moment ago, I would say that it is of course well understood that if the time phases of any number of alternating current machines are identical there is nothing to prevent their being worked in a multiple arc. Now the question in my mind was, whether there is any practical difficulty in getting those time phases the same. Of course that includes not simply the electrical and mechanical construction of the machine, it requires them to be identical in that respect. Now I have only seen two Westinghouse stations, and in both of them each dynamo had a separate engine, and in both cases the machines supplied separate circuits. Is there any case now of any plant in operation where a number of machines are successfully run in multiple arc?

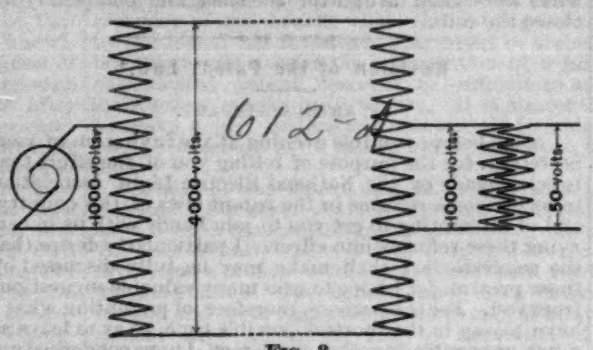
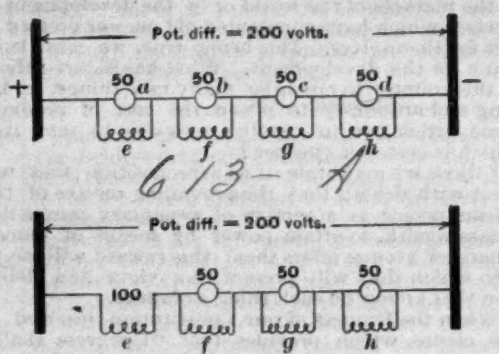


FIG. 3.

Mr. STANLEY: I think at Denver, Col., a station of five thousand lights is run with dynamos in multiple arc, although I am not sure. The Pittsburgh station has been run in multiple arc. Our policy is not to run in multiple arc. We prefer not to. There is no choice in the matter excepting only that of simple expediency. We construct the station switch-board so as to connect any circuit leading from the station to any dynamo without causing a flicker in the lights, and thus give the dynamo a definite load that you can read on the ampèremeters. That seems to us to be a very satisfactory way to run. As the evening grows later lights are cut off, the circuits are transferred from a number of dynamos to perhaps a smaller number, and eventually down to one dynamo which runs all night.



FIGS. 4 AND 5.

The subject of multiple arcing of the dynamos comes so near the question of running alternate current motors that it is the same question practically, and I feel, perhaps, justified in explaining a little phenomenon in that. If you take two alternating current dynamos and couple them together and start them up, one dynamo will fall into synchronism with the other. In order to have an alternating current motor it is necessary to have a direct current through the field and an alternating current through the armature. In order to get a direct current through the field you have got to have a commutator, which will produce the field current. This current in the field will rise from zero to a maximum value and fall again to zero value, but the armature currents will be above and below the zero value, as shown in Fig. 6. Now, notice, that at the time marked by the full vertical lines, there is no current flowing through the field, and there is no current flowing through the armature. If, then, we have an alternating current motor which is running with the exact speed and in conformity with the number of alternations of the dynamo which is applied to it, and have the phases of the two currents in exact synchronism, that is, with equal phases coming together at the same times, we will have absolutely no current in the field while there is no current in the armature of the motor. Now the commutation of the field may be outlined as shown, where *C C C* indicate the commutator segments. There has been, until the motor arrived at synchronism, commutation at different points in the phases, as at the dotted vertical lines. But when the motor runs at exactly the same speed as the alternating dynamo, there is no

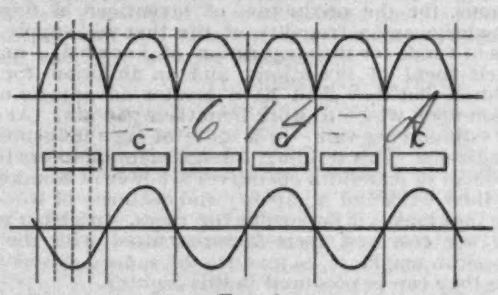


FIG. 6.

force then at work keeping the motor going. In other words, you can run an alternating current motor up to speed, but the minute it goes into absolute synchronism it will fall off again, and the consequence is that the alternating current motor will see-saw. There will be no power to continue its motion. Its speed will fall, and it will drop down to a lower number of alternations, but will rise up again.

Mr. PRESCOTT: What is the effect if you have just enough work on to keep the speed down?

Mr. STANLEY: Then it will never rise to synchronism.

Mr. E. W. RICE, JR.: I would like to ask Mr. Stanley in reference to his last statement as to the motor. How much is the variation in speed, in percentage?

Mr. STANLEY: Of course, an alternating current motor in synchronism and kept there, runs at exactly the same speed as the alternating current dynamo does. If the motor is impelled to synchronism and beyond it, it will go to perhaps double the synchronism. If the alternating current machine is run 16,000 alternations per minute, the alternating motor if it goes beyond that number would never stop until it gets to 32,000 alternations. But the chief difficulty is that it does not develop any counter electromotive force under the conditions described, because it can not develop a counter potential unless it has at all times a constant field charge. As the current falls to zero, of course, it can not develop any counter electromotive force at that time. An alternating current motor has no efficiency of any consequence until it arrives at synchronism and becomes practically a dynamo running in opposition to the dynamo applied to it, at which time it has a very high efficiency with the most perfect self regulation.

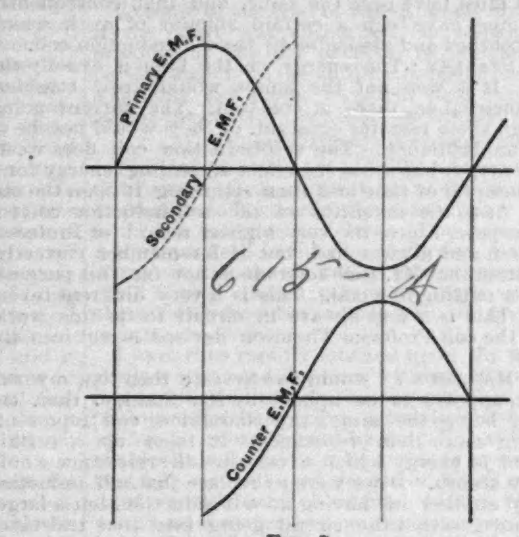


FIG. 7.

Mr. RICE: I hardly understand what Mr. Stanley means, in view of some experiments we tried recently. We had a self-exciting dynamo, and ran it in multiple arc with another self-exciting dynamo, and then threw the belt off. The current from the generator proper passed from the armature of the motor. We did not find any variation to speak of, and it ran perfectly in synchronism. It was a generator capable of giving out about twenty-five thousand watts. I then loaded it until the motor was giving out in the neighborhood of fifty thousand or sixty thousand watts without any change whatever in speed, or any tendency to variation.

Mr. STANLEY: The gentleman said he had a self-exciting dynamo. Consequently he did not have an alternating current in the field. He had a direct current in the field, which never fell to an absolute zero of magnetization.

Mr. RICE: I thought the speaker said the motor had an isolated field?

Mr. STANLEY: It had an alternating field in which the magnetization periodically fell to zero. But, in the dynamo the gentleman speaks of, I understand the magnetization of the field is always the same. Consequently it was a true alternating current motor.

MR. RICE: All that I can say is that we have run dynamos together for a period of twenty hours continuous running, and the loads seemed to be very equally divided when the speed was kept uniform. We have also experimented with motors and found no difficulty in that direction. While on the subject, I was very much interested in this system which Mr. Stanley attributes to Mr. Shallenberger. I think it is only just to Professor Thomson to say that the system was patented by him three or four years ago. He used almost identically that same arrangement, which consisted of placing the self-induction coil in place of the lamp, so adjusted that it would take just the current of the lamp. I do not know that that was the first time it was done, but so far as I know it was.

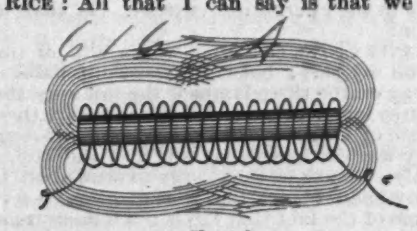


FIG. 8.

Mr. S. S. WHEELER: I would like to ask Mr. Stanley whether there are any losses on the line wire other than that of resistance—whether there is any current dissipated by retardation, self induction, or anything of that sort.

Mr. STANLEY: I was perhaps the worst frightened of any man who ever stood on solid ground when I read Prof. Hughes' lecture on self induction. But the effect of self induction which he described, and the measurements on which it was based, were made with a broken direct current. With the system that we use we have been able to find hardly any variation from the true Ohm's law, and all our wiring details are based on the assumption that the resistance is the ohmic resistance of the copper only. In the case where the wire goes around an iron core it is not necessary that there should be a loss of electromotive force. The electromotive force is merely retarded for a moment, and as soon as it has fallen to a value

below that of the charged magnetism, the stored electromotive force is all returned to the circuit. I think there is nothing so generally misunderstood as the loss of electromotive force in iron cores.

Mr. MAILLOUX: I do not think Mr. Stanley exactly answered my question, and the remarks made bring us back to it again. The question is whether in that circuit that he speaks of in which an induction coil is substituted for a lamp, whether the loss of energy or, in other words, the expenditure of energy, across that line is different in the second case from what it would be before that induction coil had been substituted. If, as Mr. Stanley argues, the effect of self induction is simply to retard the electromotive force, then evidently we still have electromotive force there, and if it does not absorb electromotive force or cause loss, then we should take less energy than would be accounted for by that which would be absorbed in the three lamps, plus that absorbed in the ohmic resistance, as he calls it, of the self induction coil. For we must remember that the amount of energy required at the terminals of the induction coil is not as much as would be represented by $C^2 R$. It is $C^2 R$, plus a certain quantity which represents the work done in the induction coil in overcoming the counter-electromotive force of the coil. Now, then, it is interesting for us to know whether in that case the expenditure of energy was the same whether the induction coil was on or whether the four lamps were burning at one time. I incline to the opinion that it must have been the same, and that consequently there must have been a certain amount of work which was absorbed and dissipated by the self-induction coil.

Mr. STANLEY: The energy on the lamp is exactly the same. If it were not, the lamps would grow brighter. The potential on them is constant. The current going through them remains constant, or they would not be of the same brilliancy. The self induction coil does waste some energy, but it has the effect of storing energy for a brief interval of time and then returning it upon the circuit. As to the invention of the self-induction coil for this purpose, I have the very highest regard for Professor Thomson and always had, but if I remember correctly, the patent that Mr. Rice refers to is not for this purpose. It is for cutting in a coil. This is a very different invention. This is a coil always in circuit to do this work, while the coil Professor Thomson devised is cut into the circuit.

Mr. MAILLOUX: I would like to state then that my conviction appears to be upheld by Mr. Stanley, that, the energy being the same, this induction coil represents nothing more than resistance. It takes up a certain amount of energy which a certain idle resistance would clearly absorb. If we were to replace that self induction coil by another one having no self induction, but a larger resistance, so that the circuit going into that resistance would absorb the same number of watts, then we would evidently have the same energy absorbed as we have by that induction coil. So that I do not see that the induction coil in question does anything more than to replace a lamp that is put into that circuit. The case is exactly analogous to that of an electric motor that would be placed in circuit. The amount of energy absorbed by an electric motor is the difference of potential at its terminals.

Mr. WETZLER: It occurs to me that perhaps this phenomenon might be due to an error, or a peculiarity, of the measuring instrument employed. Mr. Stanley said that he employed a Cardew voltmeter. I would like to know whether he ever applied the electro-dynamometer for that purpose.

Mr. STANLEY: The electro-dynamometer is a very unfortunate instrument to use with an alternating current, as its reading is changed by a slight fluctuation in the alternations. The Cardew voltmeter, which is dependent on the amount of heat produced, is entirely independent of the alternations. Perhaps I can explain that. The coil is acting exactly as a dynamo would act in series and it chokes down the current in direct proportion as the resistance in this part of the circuit is raised. The average electromotive force at the terminals of the coil, however, is greater than would seem to be warranted by Ohm's law.

Mr. HOWELL: Mr. Stanley said that, inasmuch as the current was constant, as shown by the lamps, that is, the the current in three lamps was the same as the current in four and that the electromotive force acting on the circuit was also constant—that the energy was constant in the circuit. I would infer then that $C E$ is the measure of energy in the alternating current. Is that a correct conclusion?

Mr. STANLEY: No, sir; that was a slip of the tongue perhaps on my part; but it is a most unreliable quantity. The energy on the three lamps is the same as the energy on the three lamps before. I think in reality there is very little waste of energy. But there is an apparent amount of energy wasted there—that is $C E$ of the coil. This is apparently as much as the energy expended on the lamp.

Mr. HOWELL: I think that that diagram is a very good illustration of the fact that CE is not a measure of the energy in an alternating circuit, because you have only a value for C there, and the value of the energy in that circuit would be $C \times 200$. Now that is the sum of the energies in three lamps and the coil, and in each lamp it would be $C \times 50$, and in the other it would be $C \times 100$; so that the sum of these energies is not the same as the sum of the whole circuit computed the other way, which shows that CE is not the measure of the energy in the circuit.

I would like Mr. Stanley to demonstrate why the current in the secondary increases, or why an increase of current in the secondary increases the current in the primary.

Mr. STANLEY: I think that it is very easy to understand from the diagram, Fig. 7, of the counter-electromotive force, providing no current is flowing through the coil. The secondary electromotive force will of itself induce another electromotive force, and so we might go on inducing forever electromotive forces. We cannot only transform energy once; we can transform it a thousand times. Now the secondary electromotive force will develop a counter-electromotive force on the primary circuit, and that will be still one-quarter of a period later. Notice that I have drawn these curves directly opposite. It exactly opposes the primary electromotive force at the same instant of time. Now, when current is abstracted from the coil, this is no longer the position of the secondary electromotive force; it is shifted on. Consequently, the counter-electromotive force no longer opposes the primary electromotive force at the maximum time of the primary electromotive force, and consequently its value as a counter or opposing E. M. F. is very much lessened. You have asked me a difficult question.

Mr. WHEELER: I would like to return to the three lamps in the induction coil, because I want to ask this question. Mr. Stanley stated, if connections were made between the main conductors we would have 200 volts; in Fig. 5, the terminals of coil *e* would measure 100 volts, and *f g h* would measure 50 volts, making a total of 250. Now I would like to ask Mr. Stanley what he would get if he measured the potential between the + conductor and the right-hand terminal of lamp *o*.

Mr. STANLEY: I have never tried it.

Dr. VANDER WEYDE also described some of his early experiments with the induction coil, and exhibited a number of early models, in which attempts are made to completely close the magnetic circuit of the coil. One of these, Fig. 8, was made with long wires for the core, which wires were then bent over the sides and completely inclosed the coil.

Revision of the Patent Law.*

BY ARTHUR STEUART.

I come before you this evening at the invitation of your Secretary, for the purpose of telling you of the effort that is being made by the National Electric Light Association to secure some reforms in the patent laws of this country, and of attempting to get you to join hands with us in carrying these reforms into effect. I particularly desire that the suggestions I shall make may be fully discussed by those present, for I hope to gain many valuable suggestions from you. For the purpose, therefore, of presenting what I have to say in the shortest possible time, so as to leave as much as possible for other gentlemen, I have condensed my suggestions and shall state them with very little argument; first, for lack of time, and, secondly, that I think most of the reforms suggested are so apparent that they will call forth little opposition. But, before proceeding to discuss the details of the law that require changes and additions, I cannot refrain from making a few remarks upon the patent system in general and its influence upon the industrial development of our country.

Who can measure the benefits that this land has derived from the inventions that have been produced by its citizens? The roll of honor is too long to be repeated. The cotton gin, the printing press, the reaper, the application of steam to all the uses of civilization, and, latest but not least, the modern application of electricity in its multitudinous forms; but while these brilliant achievements occupy our attention, we must not overlook the thousands upon thousands of inventions relating to matters of detail in every industry that have cheapened the product by saving time, material, power or labor. The fact is apparent that our advancement as a manufacturing nation has been due to the introduction of new methods of work which have enabled us to produce staples at such a price as to compete with other nations in the markets of the world or in the development of new devices which have supplanted old ones or created a market for themselves. This being true, we must look for a cause for this development. What has induced the people of this country to create so many new things, to labor so long and arduously to lessen the cost of production of some article, or to supply a new one to take its place which is better or cheaper?

I think we may state it as a proposition that will not meet with denial, that the prevailing motive of the American people is a motive of pecuniary gain, a desire to amass wealth, to attain power by means of money, and whatever avenue offers them this reward will be the one into which they will press with a vigor and determination that knows no such thing as failure.

When the framers of our Constitution inserted into it the clause which provides that "Congress shall have power to promote the progress of science and the useful arts by securing * * * for limited times to * * * inventors the exclusive right to their * * * discoveries," they laid a foundation stone upon which an edifice has been constructed that has far surpassed anything they had conceived. Upon this provision of the constitution is our patent law based, from it it takes its spirit, and with the view of adhering more closely to this spirit have the amendments to the patent law been suggested to which I shall ask your attention this evening.

The patent laws of the United States passed in pursuance of this provision of the constitution open up before every citizen of this country, as well as before those of many others, opportunities of obtaining wealth and power that are not presented by any other set of circumstances under the sun. In a single moment of time by a quick operation of the mind, the poor mechanic may be put into possession of an idea that by its own development may place him among the princes of the land.

This is the possibility that presents itself to every man, rich or poor, high or low, who comes to understand the meaning of our patent system and its results.

What force can be compared with this to produce in the minds of men thought, deep, concentrated and continuous, for the production of inventions, a thirst for knowledge and a frugality of life that will supply a surplus of funds for the acquisition of knowledge and the development of inventions, and an ambition for their children that they shall have greater advantages of education upon which to work than their parents? And who can estimate the value to a state of such influence upon its citizens. This training, foreign manufacturers testify, produces in American operatives a power of comprehending their work and a rapidity and dexterity of workmanship that makes it impossible for them, with labor at one-half the cost and their factories fitted with the latest American machines, to produce the same goods as cheaply as they can be produced in this country.

It therefore goes without saying that with such an inestimable good to the nation, both in improving its industries and its people, to be attained by stimulating inventors to their highest effort, the only true course for the law makers to pursue in framing legislation relative to this subject, is to endeavor to make the process of obtaining a patent upon an invention as quick, easy and inexpensive as possible, and after it is granted to throw around it in the hands of its owner every form of protection known to the law, that will enable him to realize the full intent of the constitution and enjoy the exclusive right to make, use and vend the invention.

Our patent system as it exists to-day is a grand structure, but it has some defects which are due principally to the fact that the demands made upon it by the development of our industries have far exceeded anything that the framers of the present law contemplated.

The patent law of to-day is substantially identical with the law passed by Congress in 1836. This law was revised in 1870, and codified in 1874; but few changes were made in it, and little if any protection was made, to accommodate the immense mass of business that has been cast upon the Patent Office, and some of the new features that were introduced have been found to work a hardship upon inventors rather than a benefit. So that practically we are working under a law formulated fifty years ago, when the work of the Patent Office for the whole year was something less than it is to-day for each week. Is it surprising, therefore, that the child should have outgrown his clothes? And this is practically just what has taken place. A Commissioner and a half dozen examiners were quite equal to the task of examining intelligently four hundred and fifty patents a year, but the case is a very different one when the Commissioner has under him something like two hundred examiners, and when the annual issue of the office is something over 25,000 patents.

If time permitted, I could show you how utterly impossible it is for the work of the Patent Office to be accomplished with any degree of satisfaction to the public under the prevailing organization, but I know that most of you are quite as well aware as I am of the defects that exist, and are quite as much interested in removing them. I shall pass at once to the consideration of the measures of reform that seem desirable in the Patent Office.

I.—THE PATENT OFFICE SHOULD HAVE THE EXCLUSIVE USE OF ITS BUILDING.

All those who have had any experience with the internal operations of the patent office are aware of the fact that this office is greatly cramped for space. The examiners are often crowded into rooms that are so small that there is scarcely space enough between the desks to move about. Many of the officers and employés are compelled to work in quarters that are unfit for human habitation, simply because there is no other place to put them; and the documents and records of the office are so crowded, and the places in which they are kept are so unfit for their accommodation that they are in constant danger of destruction. The patent office building was constructed with money every dollar of which was paid to the Government by patentees and applicants for patents, and yet the patent office is crowded into less than half of this building. The Interior Department, with its Land Office and Indian Department, occupy the balance.

The Interior Department should have separate quarters and the Patent Office should have the whole of its building, which will not more than accommodate it.

II.—THE PATENT OFFICE SHOULD HAVE THE WHOLE OF ITS OWN INCOME.

For the past fifty years the Patent Office has paid all of its own expenses, has built its own building, and in addition to this has paid the Government an annual revenue, which aggregates to-day, without interest, something over three millions of dollars. And yet the most difficult task that the Commissioners of Patents have had to perform has been to induce Congress to authorize the expenditure of a part of this revenue for the necessary expenses of the Patent Office. For the proper dispatch of the work of the Patent Office considerable additional force is necessary. The Commissioner of Patents should be authorized to expend the whole of the income of the office for its own expenses, and what was not spent should be set aside as a fund to be used for the benefit of the office at any time that it is needed.

III.—EXAMINERS.

The Staff of Examiners in the Patent Office have charge of public interests of a most vital nature. They are the virtual judges of whether an inventor shall have a patent for his invention at all, and also of what kind of a patent he shall have in case they give him any.

It is therefore apparent that in order that they may perform their duties with intelligence and efficiency they must fulfill several conditions:

1st. They must be thoroughly educated in the technology of the arts and sciences and in the patent law. Experience has shown that this training can only be acquired in one of two ways, either by systematic teaching or by years of experience in the practical work of the Patent Office; the latter method is the one now in operation, and it results in creating a class of examiners who are undergoing the process of education at the expense of the unfortunate inventor whose case may fall into their hands. The inventors of the country have a right to demand that this system of education of examiners at their expense be discontinued and a system adopted that will secure to the Patent Office a corps of examiners who will be thoroughly trained before they enter the office, and to the inventor the examination of his case by a man fully equipped to make such examination in the best manner.

2d. Having obtained a staff of competent and thoroughly equipped examiners, they must be retained in office, so that the public may have the benefit of their services through a number of years. The army and navy have long since solved this problem by the exercise of a system of education, compensation, promotion and retirement on pay which fully secures these ends. Why should not that system so successful in one branch of the government service be established to secure similar and equally necessary results in the Patent Office?

3. The examiners should be relieved from all political influence. Civil service reform has attacked the question of political interference with Patent Office appointments with little success. The evils from this cause now existing are great and call loudly for remedy. The army and navy system has put those departments of the public service almost entirely beyond the reach of the politicians. Thus it should be with the Patent Office.

IV.—SALARY OF COMMISSIONER OF PATENTS.

The salary of the Commissioner of Patents should be very high, so that every examiner may feel that if he is faithful and does his duty he may some day, in the natural order of promotion, reach a place of honor and large emoluments. This is the system of the army and navy, and in those departments it works admirably.

V.—A PATENT COURT SHOULD BE ESTABLISHED.

The greatest evil that exists to-day in the administration of the patent system, lies in the lack of harmony between the Patent Office and the courts of the United States in which infringement cases are determined. Every practitioner before the Patent Office knows how little regard is paid by the examiner to the decisions of the courts upon questions of patent law, and it has long since become a thing of the past when the courts give any weight to the presumption of patentability that would naturally arise from the fact of the Commissioner of Patents having

* Read before the American Institute of Electrical Engineers, New York, Dec. 26, 1887.

granted a patent upon a device. For the accomplishment of the best results with our patent system, the interpretations and application of the law under which patents are granted should be the same as that under which rights growing out of patents are determined. So that a right granted by the Patent Office would be sustained by the court, and the rulings of the courts would be in conformity with the spirit of the constitution which has originated the whole system.

Under the existing system the examiners in the Patent Office interpret the patent law for themselves, and it has been my experience that few of them agree upon many points. The practical questions which have to be passed upon by the examiners seldom if ever get before the Circuit Courts, but are decided by the Commissioners of Patents, who, it is well known, seldom possess any knowledge of patent law when they enter upon the duties of the office, and seldom occupy the position long enough to be of any practical service to the office after they have learned something of the law by experience. The result is that a majority of the cases passed upon by the Commissioners, and which are intended for the guidance of the examiners, are decided at a time when the particular Commissioner is almost entirely ignorant of both the law and the practice of the office. It is, therefore, only to be expected that the examiners should form their own notions of the law and pay little regard to either Courts or Commissioner, and as the examiners are not lawyers and have no knowledge of the patent law, except such as they may gain from the conflicting decisions of the ever changing Commissioners, and as they have had no judicial training, it follows as a matter of course that each primary examiner has his own interpretation of the law and his own peculiar notions of how it should be applied to the practical questions that arise in his daily work. The result is that we have as many different patent offices as we have divisions and scarcely any two of them with the same views of the law, but each having the power and exercising it, of issuing patents according to his own individual notion of what the patent should contain and how it should be framed, and these patents thus issued are the title papers upon which the inventors of the country are compelled to base their claim when they come into the courts for the purpose of protecting their property. Is there any wonder that it is difficult to obtain a patent of any value or to sustain and protect it after it is procured? It seems, therefore, to be eminently desirable that the same tribunal (which shall be so framed as to insure its capacity) should have apellate jurisdiction from both the Patent Office and the Circuit Courts, so that by vesting both jurisdictions in one competent court, the rulings of both branches, the Patent Office and the Circuit Courts, may be made uniform, and the anomaly removed that now exists, of one branch of the government employed in granting patents and another in destroying them. It may be said that such a court exists at this time, but we all know how far removed the Supreme Court of the United States is from the Patent Office, and how little influence it has upon its practice, beside which the existing evils have grown up under the present system, which demonstrates its incapacity to remedy them.

A strong, well-selected court of expert patent lawyers, would have many advantages. It would harmonize the Patent Office and the Circuit Courts. It would crystallize the practice of the Patent Office, so that it would be possible for attorneys to form some conception of what that practice was and be able to advise their clients with safety with reference to their rights. The inventor could have some hope that when he had complied with his part of the government contract by disclosing his secret he would be protected in the exclusive right to use it. Such a court would lift a great burden from the shoulders of the Supreme Court, as but a small proportion of cases decided by it would be appealed to that court, and its rulings being binding upon the Circuit Courts, would enormously simplify the practice in those courts.

The jurisdiction of such a court should be altogether appellate, and should consist in appeals from the Board of Examiners in Chief upon questions of anticipation, patentability and practice, from the Examiners of Interference, upon questions of priority between applicants for patent upon the same invention, and of appeals from the Circuit Courts of the United States upon all questions relating to patents that now go to the Supreme Court. It would be proper also to include within the jurisdiction of this court all questions now passed upon by the Commissioners of Patents, such as trade-marks and labels; copy-rights might also be included. With such a court the duties of the Commissioner of Patents should be purely executive, and the jurisdiction of the Supreme Court of the District of Columbia in matters of appeal from the commissioner, should be cut off. The Supreme Court of the District should bear the same relation to this court as the Circuit Courts.

Passing from the question of the reorganization of the patent office to specific amendments to the law, the first question that presents itself is the question of limitation to actions.

VI.—LIMITATIONS.

It is pretty well settled by the courts that since the adoption of the Revised Statutes of 1874, there has been no limitation to the right of an owner of a patent to bring suit against an infringer for the recovery of damages for such infringement. Prior to that time, the only limitation that existed was six years after the expiration of the patent, and this seems to be a just rule. Many rules for limitation have been suggested, but it seems to me, in view of the fact which all of us have experienced, that the last few years of a patent are often the only ones during which the inventor realizes anything from his invention, that to cut him off from the recovery of damages from infringers, who may have pirated his invention during a period when he was too poor to stop them, would be unjust in the extreme.

VII.—DAMAGES.

The existing equity rules for the recovery of profits and damages for the infringement of a patent are in very satisfactory shape, but since the decision of the Supreme Court in Root vs. The Railroad Co., these rules do not apply to actions brought for the recovery of damages after the expiration of the patent. Such actions must be brought at law, by an action of trespass on the case, and the measure of damages under that form of action is much less literal than the rule in equity. In an action of trespass on the case the measure of damages is the actual loss to the plaintiff and not the gain to the defendant; while in equity, the rule allows the recovery of either the loss to the plaintiff or the gain of the infringer, whichever may be the greater, and often the difference is very great. If it is just and right that the owner of a patent should have all the benefits that may or can be derived from the use of his invention, and this is the theory of the law, and in one form of action before the expiration of his patent, is allowed to recover these benefits; in the absence of a statute of limitations, why, in justice, should he be deprived of this benefit simply by the expiration of his patent? It would seem as if this evil should be remedied by legislation. It might be done by giving a plaintiff a standing in equity under a bill for an account and discovery, independent of an injunction; or if the patentee were permitted to bring an action of assumpsit for recovery of the benefit that the infringer had derived by the use of his invention, this might be almost as well; but this would require the interposition of a jury, and in complicated patent cases it is difficult to accomplish satisfactory results with a jury. It is almost impossible to make a jury understand mechanical technicalities or for the attorneys to do justice to the case upon oral testimony.

We have at this time a case in point which illustrates this rule. For seven years the owners of certain patents have been in constant litigation seeking to sustain them. We have recently succeeded in getting a decree in their favor, and a month before this decree was rendered the patents expired. The patents have been extensively infringed and cover important inventions. We have now no remedy save to sue at law by an action of trespass on the case. As a matter of fact the owners of the patents have never established a license fee for their use, but if they had, as they might have done, it would not probably have been more than $10 for each machine. Hence, this sum in our action at law would have been the limit of our possible recovery; notwithstanding the fact that the infringer by the use of each machine has saved to himself not less than $500. Why should the rule of law in a case like this be different from that in a case where a man without my knowledge or against my will carries off my horse and uses him for his own benefit for a certain period, after which I recover him? In such a case I bring a suit and the jury estimates the benefit that the wrong doer derived from the use of my horse and awards me this amount as damages for his wrongful act. Would it be right that this wrong doer should have the power of escaping liability by answering when the jury found that he had made $100 by the use of my horse, that I could not in the same time have made but $10 with it? Would not this be putting a premium upon the wrongful act?

The question is still an open one whether in those States where the common law forms of action have been abolished, an action could be maintained at law for the infringement of a patent, the substantial result of which would be the same as the common law action of assumpsit, although the statute prescribes an action of trespass on the case as the proper action.

VIII.—REISSUES.

Since the decisions of the Supreme Court in Miller vs. The Bridgeport Brass Company and the line of cases that have confirmed this doctrine, it may be said that a reissue, in the sense in which that term was formerly employed, is no longer possible. The unfortunate inventor who has employed, in his ignorance, an incompetent solicitor to procure his patent, or who yields to the unnecessary limitations of the office, and whose patent issues to him covering half of his invention, or possibly contains a disclaimer disclaiming the other half, can be said to-day to have no remedy for his misfortune; and if two years have elapsed since he procured his patent, or some enterprising manufacturer examines his patent and finding that he has not covered the second half of his invention, proceeds to make and sell that half, he is forever barred from going back and claiming it. Some change in the law should surely be made to enable an innocent and meritorious inventor to secure the full benefit of his invention, if this can be done without destroying vested property rights in individuals.

Under the present law, when a patent is surrendered in order to obtain a reissue, all accrued causes of action for past infringement upon the original patent go with it, and no action can be brought for an infringement committed prior to the date of the reissue. There does not appear to be any good reason for the existence of this rule.

At present an application for a reissue must be signed and sworn to by the inventor. This rule puts it into the power of a dishonest person to extract money from the owner of the patent by refusing to sign the reissue papers. The owner of a patent should have the power to deal with his property as he chooses, and as he is considered, when he purchased the patent, to have purchased all that could have been covered by the inventor's original application, if the patent does not do this, he should have the power to reissue his patent upon his own petition, and an oath that he is the sole owner, or if there be several, that they own the whole title.

IX.—REPEAL OF PATENTS.

The statutes of the United States contain no provision which will permit a patent supposed to have been obtained by fraud or mistake, to be set aside, nor for any action by the United States against the owner of such a patent to prove the fraud and have the patent declared void. The statute should contain such a provision.

X.—EQUITY PROCEEDINGS FOR SLANDER TO PATENT.

Neither statute nor precedent in this country authorize an equity proceeding for an injunction to restrain the continuance of slander against a machine or a patent, by one who falsely charges that the machine or the patent is an infringement of another patent owned by him, and threatens suit for such infringement, but neglects to bring such suit, and who thus continues to disturb the business of the party slandered without attempting to execute his threats or to vindicate his claim. Such an injury cannot adequately be remedied by an action at law for damages. What is wanted is an injunction from a court of equity to stop the tongue of the slanderer at once and forever.

XI.—LICENSES.

Licenses should be recorded and subject to the same rules as mortgages of land; the license first recorded should take precedence.

XII.—JOINT OWNERS.

The mutual rights of joint owners of a patent are in a very unsettled state in the present condition of the law, and it would, I think, be much safer to say that joint owners are entirely independent of one another,—although there are some cases to the contrary,—than to venture any statement with reference to what those mutual rights may be.

It would seem that no good reason could be advanced why joint owners of a patent should not bear the same relation to one another as joint owners of any other property. If two persons own a house jointly, but in definite proportions, and one of those persons rents the house and receives the rent for it, the other can, of course, receive his share of the rent either from the person or from the property. The absence of well-settled rules upon this subject makes it very desirable that they should be established by statute.

XIII.—U. S. PATENTS LIMITED BY FOREIGN PATENT.

A United States patent should not be limited to expire with the shortest lived foreign patent upon the same invention, for the simple reason that the American inventor who gives his invention as a free gift to the foreigner, gets a patent here for 17 years, while he who seeks to protect himself abroad may limit his United States patent by several years.

XIV.—ASSIGNMENTS.

Assignments of patents should stand upon the same footing as conveyances of land; the assignment first recorded should take precedence.

XV.—EXPENSE OF LITIGATION.

Expense of the trial of patent cases might be lessened if the court was authorized, in impaneling a jury as provided by the act of 1875, to impanel a jury of five persons expert in the subject matter of the case, pay them a suitably per diem, let them hear the testimony, and advise the court. Cochrane vs. Deener, 4 Otto, 784.

XVI.—INTERNATIONAL CONVENTION.

The United States by its adherence to the International Convention pledged itself to adopt legislation as soon as possible to harmonize the existing law of this country with the international law. The practical result that Americans need in relation to foreign patents is a period of say six months after they have secured an allowance of their United States patent to make their applications abroad without affecting the term of their United States patent.

I have thus rapidly touched upon the points in our patent law that need revision, without attempting to formulate specific additions to the statutes. This, I think, can only be done effectually by a commission of expert lawyers, such as is contemplated by the bill that we propose to introduce into Congress. In order to secure the passage of that bill, we will need the aid of every man who is interested in this subject exerted to the fullest extent, we would most earnestly urge the importance of this effort in its possible effects upon the country, and solicit your assistance in making it successful.

Long Runs With Storage Cars.

To the Editor of The Electrical World:

SIR: Mr. Wharton's reply to my previous communication shows a disposition to scold at my boldness in presuming to make a fair exchange of the forty miles of the Julien car for the forty-five miles of his car. Mr. Wharton also has the evident impression that his "laboratory" track represents all that is crucial and severe, and that if a car passes that "examination," it will be like a young graduate, prepared to tackle anything that comes along. I am, of course, ready to admit frankly that his piece of track is not a mere "walk-over," but I do feel that he has yet something to learn of what some street cars have to crawl over in actual practice, until he has seen, or learned of, the track on which the tests cited by me were made.

It was my intention to have said something about the track in my previous communication, but I presume that I overlooked its importance on account of being too much accustomed to it. I fear that in doing so I have left Mr. Wharton and the readers of your interesting paper under the impression that I experimented on a fine straight, smooth, in fact an ideal, track, and I will consequently encroach upon your space with a few details.

A little over five miles were run on the Fourth and Madison avenue track, extending from the stables at Thirty-second street to Eighty-fifth street. The run through the tunnel is the nearest to level ground, being under 1 per cent. From Forty-fourth street to Eighty-fifth street the track is a succession of long grades, varying from 3½ to 4½ per cent. In these five miles the car described fourteen curves, four of them on grades and only two of them with a radius of over 30 feet. But these two and a half miles of road were simply fine compared with the two and a half miles of the suburban extension from Eighty-fifth street to and over the Harlem River, on which the remaining thirty-five miles were run. This part of the road begins with a grade of about 5½ per cent., which is over one block long. At about Eighty-seventh street begins a slope that would perhaps delight the heart of the "tobogganer," but which makes the partisan of electrical traction tremble. When he glances over the tops of the high buildings at 110th street and beyond, and realizes that the car has to crawl up again, he is apt to feel nervous. After I had made the trip a couple of times, I recollected Virgil's line—

Facilis descensus Averni, sed revocare gradus—

and I concluded that surely this must be the very Avernus of place he had in mind. The grade varies from 4 to 4½ per cent., and is not far from three-quarters of a mile in length. But this grade pales into insignificance before the track. The street is not graded from this point to the other end of the track, and it is a sight to behold. The track is laid as best as it can be, with the rails mounted on timbers. The horses "plod their weary way" between the timbers, and occasionally dig up a trench on the grades and around curves. The railroad company would be doubtless very glad to build a good road, but it naturally

does not care to pave the whole street besides, to say nothing of removing obstructions. As it is, the track, which is single, with one or two "pass-byes," is laid sometimes on one side of the street, sometimes on the other, and occasionally in the middle. The track makes sundry turns and *détours* to avoid obstructions or to graciously leave the right of way to some builder who has the street converted into a brick-yard. Nor are these oscillations from one side to the other made by easy curves. It generally seems to the passenger as if the car were trying to turn in its own length. There may be a few of these S-curves where the radius comes up to 30 feet, but I am certain that the majority are under 25 feet. At some points, such as at Harlem bridge, the track makes an angle and not a bend, so sharply does it begin turning. This road has no less than eight S-curves and three single curves, not counting one or two single curves of over 100 feet radius. The entire road is a succession of long grades of between 2 and 3 per cent., from 110th street to Harlem River. It is seen that in these 35 miles the car described over 100 double or S-curves and over forty single curves.

I have only one more item to speak of—*the mud*. With heavy trucks carting away stone from the quarries along the line, or transporting building materials on a road not graded, the condition of affairs can be imagined. On the grades this mud makes the track slippery. On the comparatively level portions, where Mr. Wharton thinks we derived so much advantage, the mud is in many places even with the top of the rails. There are even places where the rails are submerged, in some cases with mud, in others with water, and there is danger of running off the track, particularly on curves, where the grooved rails are usually completely filled up.

The above will suffice to show, I hope, *what became of the five miles!* If Mr. Wharton will reconstruct his track in accordance with the specifications of this one, not omitting the mud, it is probable that his car will also lose a few miles. I was informed by an official of the road a few days ago that the track is now in much better condition than it was then. But I am under the impression that even in its present improved state, it only needs to be seen to be fully appreciated, and that those who take occasion to inspect it will find cause to at least respect, if not admire, the 40-mile record made by the Julien car.

C. O. MAILLOUX,
Consulting Electrician to the Julien Electric Company.
BOSTON, Dec. 13, 1887.

On the Analogies of Influence Machines and Dynamos.*

The author, after remarking that it was impossible for the striking analogies between influence machines and dynamos to escape the notice of any one who had worked much with the two classes of machines, expressed a hope that by means of these analogies the present confused nomenclature of influence machines might be reduced to something like order, and then proceeded to point out the analogies, which are almost all worthy of note, though want of space compels us to confine our attention to some of the more obvious ones.

Every influence machine except the "Wimshurst" consists of a fixed and a moving part corresponding to the field magnets and the armature of a dynamo. The fixed plate of the former carries two inductors corresponding to the two poles of the field magnets, and the author proposes to call these inductors "field plates," while the rotating portion he would call the "armature." In the case of the Holtz machine this term has already been used, but in the opinion of the author wrongfully, for the paper sectors on the fixed plate. As Professor G. C. Foster subsequently pointed out, this was in accordance with historical analogy, as the term armature originally denoted the iron pole pieces attached to a natural magnet or loadstone. In the Wimshurst machine both plates rotate, and each acts as a field plate to the other as armature, so that the analogy still holds, and it was pointed out that it was on account of the great weight of the field magnets of a dynamo that the armature was always selected as the moving portion, together with the mechanical difficulties which would arise with regard to the arrangement of the collecting brushes if the field magnets were made to revolve. It has, however, actually been proposed to obtain a greater relative velocity between the field magnets and the armature by causing both to rotate in opposite directions; but it is difficult to see any advantage in such an arrangement which would compensate for the mechanical difficulties to which it would give rise. In ordinary dynamos the armature is wound in sections, and the E. M. F. obtainable at a given speed increases with their number. The author considered that the analogy here partially failed; a large number of sectors in an influence machine would give a low E. M. F., as there would be less insulation between them. Professor Ayrton subsequently pointed out that the want of insulation was merely a defect of construction, and could be remedied by increasing the size of the plate, and thereby allowing a greater distance between the sectors; and he maintained, in opposition to the author, that if sufficient insulation were insured the E. M. F. obtainable at a given speed would be directly proportional to the number of sectors. The author also compared the different kinds of influence machines with series, shunt and compound dynamos, respectively, and pointed out how they might be classified by the analogies between their armatures and the various classes of dynamo armatures. The two classes of machines resemble each other in their power of self excitation from the residual magnetism of the field magnets and the residual electrification of the field plates respectively; and while bad iron is better for the former, as it retains more magnetism, an influence machine will excite itself better if paper is interposed between the metal field plates and the glass, probably because of the residual charge retained by the paper. Professor Rücker during the discussion stated that the large Wimshurst machine in the Science Museum had recently been found to retain its power of self excitation after having remained unused, and kept without any special precautions, for over a year. One of the most interesting of the analogies pointed out by the author was the displacement in the direction of rotation of the electrostatic field of an influence machine, corresponding to the similar displacement of a magnetic field in a dynamo. An important practical detail pointed out by the author was that in constructing an influence machine the field plates should be separated from the armatures by two sheets of glass or other insulator, as otherwise the power of self excitation would be diminished by one of them being discharged upon, and he suggested that Clarke's gas lighter would probably be considerably improved if it were possible to place the tinfoil field plates outside the ebonite case, instead of inside.

* Abstract of a paper read by Prof. S. P. Thompson, before the Physical Society of London, Nov. 26.

ENGLISH NOTES.

LONDON, Dec. 6, 1887.

There is reason to believe that we are upon the eve of a very considerable extension of electric light enterprise in this country. The financial success of the Ferranti transformer installation in the West End has already given rise to a whole crowd of half-fledged schemes, and every one is eager to stand in for the coming boom. For the present, however, there is a good deal of uncertainty about the actual extent of existing patent rights, and responsible persons are reluctant to commit themselves to a definite course until the result of the action now pending between Gaulard-Gibbs and Ferranti (the Sir Coutts-Lindsay Electric Lighting Company) shall have been decided. In the first of these actions Ferranti presents a petition for the annulment of the Gaulard-Gibbs patent on the ground of a flaw in the specification, and also on the ground that the subject matter is not suited to the grant of patent rights. A suit of later date has been entered by Messrs. Gaulard & Gibbs, in which they seek damages against Ferranti for infringement. The first case came before the courts a few days ago on a technical point, Messrs. Gaulard & Gibbs seeking to amend their pleadings. This was only granted on condition that they paid the whole of the costs incurred up to date. Unfortunately the issue of this trial will scarcely prove conclusive, inasmuch as the United Electrical Engineering Company hold a patent of earlier date by Jablochkoff, which may possibly be considered to confer the exclusive right to the system.

Meanwhile several important firms are making quiet preparations to enter the field at the earliest opportunity, and when the proper time arrives it will be found that in both alternating current dynamos and in the transformers there are devices of a very pretty character which have yet to be disclosed.

Apart from the technical merits of the induction methods, there are two very practical reasons why the system stands so great a chance in London. First, because, owing to the possibility of employing overhead wires, the installations do not come under the shade of that deadly upas tree—the Electric Lighting Act, 1883. Secondly, because of the very large number of isolated installations already in existence, the owners of which would be in very many cases only too glad to get the chance of taking current from a central lighting station and dispensing with their own machinery.

The secondary battery people do not, however, intend to allow these new opponents to have everything their own way. A pamphlet has just been issued by the Electrical Power Storage Company, in which after a vigorous attack upon transformer systems, they announce a forthcoming installation of four to five thousand lamps on the system which is known in this country as the "BTK," from the initial letters of the engineers who first attempted to carry out the method at Colchester in the year 1883. Distribution is effected from sub-stations in which secondary batteries are charged in series and discharged in parallel. Two sets of batteries are provided, one set always being on the discharging mains and the other either in the charging circuit or awaiting discharge. The whole of the connections are made by automatic switches which are governed by a "master-cell." This cell is provided with a hood by which the evolved gas is collected and, passing into a small reservoir, actuates a water gauge which, by means of a float, closes the circuit of an electro-magnet, which finally reverses the connection when the charging is complete. There are other devices of a somewhat elaborate character which are intended to insure the safe working of the system; but on the whole, although admittedly somewhat complex, the arrangements appear to have been carried out in a thoroughly practical and workmanlike manner, and—always provided the master cell does its duty—there seems to be little to fear as regards the efficiency of this portion of the system. It is, of course, impossible for secondary batteries to compete with transformers in the matter of first cost, and it remains to be seen whether the additional safeguard of a storage system is a sufficient set-off for the extra cost.

A writer in *Industries* last week, who must have been at the time of writing unaware of the approach of this scheme, estimates the initial cost of distribution by secondary batteries compared with alternate current transformers, as standing in the ratio of 60 : 32; rotary transformers he puts down at 52 on the same scale.

A great deal of interest has been aroused by the paper read before the Society of Telegraph Engineers and Electricians by Professors Ayrton and Perry on their new voltmeter. You will already have learned that the new instrument is an adaptation and improvement upon the "Cardew." The complete paper, which will be of a very elaborate character, has not yet been published, but over two years have already been expended in investigation and experimenting upon the instruments, so that it may be expected that they will be placed upon the market almost simultaneously with the publication of the paper. The great advantage which these instruments possess over the original "Cardew" consists in their extreme accuracy at both ends of the scale; an instrument capable of reading up to 200 volts may yet be used with perfect certainty for the measurement of 2, 3 or 4 volts, while instruments specially calibrated up to 50 volts, will read with ease and certainty to 0.25 volt. The want of a reliable voltmeter for small measurements has long been felt, and if this were the only advantage of the new instrument it would be a very practical one. But unlike the "Cardew," the instrument is of a readily portable character, being contained in a circular box about 4 to 6 inches in diameter.

Dr. Fleming's ammeters and voltmeters which he has worked out in conjunction with Mr. Gimingham and which were described and exhibited at the same meeting, are instruments of an altogether different character. Their design is, in fact, merely a refinement of the well-known "Siemens" dynamometer, and they are read in the same way by turning a torsion spring provided with a milled head and a pointer. The instrument is likely to be of considerable value under certain conditions, but cannot be said to have any great importance in practical engineering work.

The proposed association of electrical engineers in this country seems now in a very fair way to be carried to a successful issue, the feeling of the overwhelming majority of practical men is unmistakably in favor of the movement. It is perhaps a pity that the technical press has not shown a greater unanimity of feeling upon the subject, for although the journal which has taken the most prominent part in the matter has received consistent support from one other technical journal, the remainder of the press has been either undecided or lukewarm in the matter. This is the more to be regretted because, as a matter of fact, every effort was made by the journal upon whose shoulders the work has devolved to secure the co-operation of the entire technical press. The next step will probably be the calling of a public meeting, and the question will then, no doubt, be fully discussed and some definite line of action decided upon.

Some interest has been excited by the acceptance of the challenge of the owners of the Holmes-Burke primary battery, who have offered to stake £25 upon the result of a public competition of their own battery with others. This challenge has been promptly taken up, and it appears probable that the competition will shortly come to pass.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, Dec. 19, 1887.

Everybody is watching with great interest the advance of electric locomotion, and nowhere is curiosity on the subject keener than in New York. The following remarks from the *New York Times* are pithy and pertinent: "Electricity on the street-car lines of this city is bound to come. The change is only a question of time. Such is the popular and growing sentiment, and the railroad company officials, especially those of the Fourth avenue organization, manifest a disposition to make the revolution of progress demanded. One of the gentlemen connected with that corporation said last evening that an electric system would be adopted just as soon as its merits and practicability had been satisfactorily demonstrated. "I mean by that not a wind and paper test; but a genuine, systematic trial on our plant. For some time we have been experimenting, off and on, with the Julien invention, charging the storage batteries with one general utility engine, and running the car over the tracks. This may all be very well, for outsiders, and from a picturesque point of view, as marking an era in the march of science and progress; but as an experiment it won't do for us. I must say that we are very favorably impressed by the exhibitions; in fact, so strong is our opinion that horse power must go that we have determined to hasten its retirement. Perhaps within 30 days we shall have completed necessary arrangements for making a test of the new motor, according to our ideas of ascertaining its cost and merits as compared with the existing service. It is represented to us, I know, on the basis of foreign statistics, that electricity is cheaper than horse power for our use, and we propose to find out if that is true by setting up a boiler and engine, and operating a specimen plant distinct from, but in comparison with, our present system. It is a point of great importance, and we are not only curious but anxious to have it settled. The experimenting will be continued this winter, and if the results are what we hope, the company will be in a position to act intelligently. The Julien system, so far as we have discovered, answers the purpose, but we must test it longer. It is the only invention of the kind we have considered, and we shall take up no other system until through with the one in hand. I think in the spring the public will know definitely about the present imperfect improvement." This statement about the Fourth avenue road I am in a position to confirm, for the management have made up their mind to set a notable example here, and their action is of the utmost importance as marking a definite point of departure.

I regret to note the destruction by fire of the lamp factory on Park avenue, Brooklyn, of the Consolidated Electric Light Company. The disaster is said to have been caused by the explosion of a barrel of chemicals on the third floor. The fire occurred at 3 P. M. on the 13th inst, and the building was emptied of employés in double quick time. No lives were lost, and the engineer showed great pluck in going through the dense smoke to his boilers to let off steam, in order to prevent an explosion there. The loss on stock and machinery has been put at $25,000, and on the building at $10,000. Fortunately the new factory of the company, on Twenty-third street, this city, will soon be ready, so that no great delay or hardship will be experienced.

Hazazer & Stanley, of Frankfort street, intend to increase their facilities for wiring for electric light, in addition to their other work, and have secured experts in this class of work for their regular staff. The business of the firm is being built up on the best of bases—that of hard work done intelligently and thoroughly.

Mr. J. E. Cochran, of Chester, Pa., informed me last week that the Pennsylvania Chemical Electric Light Company of that place had several plants of good size in use, employing the Gibson storage battery. One of these of 22 cells is charged from a Kimball & Davis dynamo run by a Tuerk water motor. The plant in the offices of the company on Market square is run by a Jackson "Hecla" dynamo driven by a Shipman oil engine of 5 h. p.

The following was in the N. Y. *World* recently: "A new system of lighting the Fifth avenue stages with electricity was tried last evening, the inventor of the system being a young lady of this city, Miss Ella Neilson Gaillard. The stage selected for the experiment, though a new one, was of the old pattern, the absence of the rear door of the new English stage being an obstacle to lighting the imported stages by the new system. In the stage last evening was placed a battery weighing 132 pounds which supplied the electricity for two lights of a power of six candles each. The battery in each stage will run for 30 hours, the lights burn-

ing five hours each night. The stage when lit up presented a very brilliant sight. It is the intention of President Ely Goddard to place a battery in each stage should the experiment prove successful."

Chas. A. Schieren & Co. report sales of leather link belting as follows: Edison Electric Illuminating Company, Brockton, Mass.; Burlington Gas Light Company, Burlington, Vt.; Wilmington City Electric Company, Wilmington, Del.; Pawtucket Electric Light Company, Pawtucket, R. I.; Wachusett Electric Light Company, Fitchburg, Mass.; Sayles & Jenks, Warren, Mass.; Lawrence Electric Light Company, Lawrence, Mass.

The Sprague Electric Railway and Motor Company report an active demand for their motors from all parts of the country. One Sprague motor has been running for six months, day and night, without a stop, at Pittsburgh, furnishing power for the Telephone Exchange and taking current from the Allegheny Electric Light Company. The Sprague Company have also received orders for two motors of 40 h.p. each for the new Court House at Pittsburgh, where they will be employed to drive ventilating machinery. They have now about 80 motors running in New York City alone, from ⅓ h.p. up to 15 h.p., and there seems to be quite a rivalry between the Sprague offices in New York and Boston as to which shall have the largest number of motors installed. The company has just closed an important contract for power transmission for a Colorado mine.

The telephone investigation here was brought to a close last week. Some more experts were examined, including Mr. W. H. Eckert, Mr. J. A. Seely, Mr. W. A. Hovey, Mr. E. J. Hall, Jr., and others, all of whom elucidated many valuable points for the benefit of their auditors. It was reported at the last session that the New York Board of Trade and Transportation had issued 500 circulars to telephone subscribers in this city, inquiring as to the nature of the service given. It had received 248 replies, of which 31 described the service as good, 17 as fair, 66 as bad, 77 made no complaint, and 57 regarded the charges as extortionate. Several leading merchants and manufacturers also appeared before the committee to tell what they thought of the telephone in New York. From this city the committee went to Rochester and took a little evidence as to the telephone troubles there.

The Empire City Electric Company, of this city, was organized in October, 1886, to do a retail business, with headquarters at 779 Broadway. Its business increased to such proportions as to necessitate the occupancy of additional premises at 15 Dey street last August, and the establishment of manufacturing and wholesale departments. Their catalogue, issued recently, is a most creditable production, covering the whole field, and is well worth study and preservation. The retail store at 779 Broadway has a fine line of electrical novelties for the Christmas holidays, and attracts crowds to its windows and counters.

Ex-Congressman Charles L. Mitchell, of New Haven, has nearly completed arrangements to organize a new company and take up the business of the suspended firm of Mitchell, Vance & Co., the manufacturers of gas fixtures and brasswork, who are now in the hands of Receiver Gilroy. He proposes a cash capital of at least $125,000, and to settle with creditors with cash and notes secured by mortgage.

The tendency of the copper market is still upward, but it would seem that the advance in the price of wire is not made with equal steps, though there is a good deal of list revising. It may be said that for the present the prices of to-day are not those of to-morrow.

A very interesting sight is that to be seen at 178 Broadway, in the show windows of H. C. Squires, dealer in supplies for field, forest and stream sports. The aquatic portion of the exhibit includes a handsome Rushton boat fitted up with that sturdy, compact motor, the "C. & C." The motor drives a small screw propeller, and takes current from a couple of Roberts-Brevoort batteries. These batteries and the same motor also run a large bicycle. The boat exhibit is certainly very significant, and I believe we shall see a good deal of work done in this line next year. Speaking of the battery, Mr. Squires told me, on inquiry, that he expected to get about one day's work out of it, and he had already taken four. He regarded the equipment as a marked success, and is ready to fill any quantity of orders for it. Such a rig, running a boat cheaply, as it does, and dispensing with all labor or hire of boatmen, is bound to meet with a big demand. No space is occupied; no noise is made; there is no danger of a "blow-up," and the attention required is infinitesimal. Besides, after using the batteries and motor during the Summer vacation, you can unship them and take them home to run a sewing machine, a lathe or a jig-saw. Great is electricity, even in its minor applications!

W. T. H.

CHESTER, Pa., Dec. 19, 1887.

The business of the Chester Foundry and Machine Company is under the care of Lewis Miller, general manager, and Theo. W. Stone, secretary and superintendent, both of whom are experts in this line of industry. Electrical castings and construction are also their specialties. They are now building the Brotherhood three-cylinder engine, with many improvements over the English make. There are ball joints in each one of the three piston rods, the exhaust passing through the back of the ball in the joint into the central exhaust chest of the engine. Each cylinder takes steam at the outer end. The governor of this engine is a novelty, consisting of two bronze balanced weights carrying a steel rod with a key at the end to fit a slot in the end of the crank-shaft. A spring resting against the end of the above rod permits the weights to open and close the three ports of the cylinders, allowing enough steam to vary the speed of the engines, which are made to run any number of revolutions up to 3,000 per minute. The company have every facility to handle their products, in foundry and machine room. They have a 50 foot crane running the width of the central portion of the foundry, and one is being fitted in the machine room with 50 feet shop room on either side of the crane, which is made of boiler iron and is suspended 20 feet above the floor. The cranes will run the whole length of each room, 300 feet, and raise, lower and carry to both sides all at one time. In a room at one end of the foundry is a 20 h. p. Brotherhood engine, running a 16-light Ball dynamo for lighting the shops. The company are to put in Gibson storage batteries to supply incandescent light to the offices, which are all fitted for it. The dynamo is a 10 ampère machine. Schaeffer and Budenberg tachometers are used for indicating the speed of the dynamo at any time; it is kept at 1,200 revolutions. A 75 h. p. Brotherhood engine runs the foundry, and the same provision is made for the machine room. The New York office of the engine is in charge of Mr. Alfred Brotherhood, 111 Liberty street, New York.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Dec. 19, 1887.

Mr. J. Frank Morrison, of Baltimore, President of the National Electric Light Association, was in Boston during the past week making arrangements for a suite of offices for the New England branch of the Baxter Motor Company. It is probable that quarters will be secured in the John Hancock Building, No. 178 Devonshire street.

Among other recent arrivals in Boston of well-known electrical people were Mr. Theo. N. Vail, Mr. George F. Porter, of the Faraday Carbon Company, Pittsourgh, Pa., and Mr. J. W. Marsh, of the Standard Underground Cable Company, Pittsburgh, Pa.

The New England branch of the Sawyer-Man Electric Company has installed recently the following incandescent isolated plants, viz.: 250 lights in the large establishment of Messrs. C. I. Hood & Company, Lowell, Mass., the well-known sarsaparilla manufacturers, and 75 lights at the Harvard Mills, Watertown, Mass., the property of the Union Carpet Lining Company.

The Holyoke, Mass., Water-Power Company, which holds from the Massachusetts Legislature authority to furnish gas, has petitioned the Board of Gas Commissioners for permission to supply electric lights.

The Claremont, N. H., Electric Light Company, which organised recently, has elected its officers as follows: President, Ira Colby; treasurer, Chas. H. Clark; secretary, John L. Farwell, Jr. The stock of the company is said to be chiefly held by citizens of the town named.

It is authentically reported that the New London, Conn., Electric Light Company has decided to equip its station at once with Thomson-Houston arc-light dynamos and the Westinghouse Company's alternating machines. The lighting capacity of the former will be 100 arcs and of the latter 1,300 incandescents.

The Woodward Underground Telephone and Telegraph Company, of Lynn, Mass., has its force busy putting down wires in the city. Its system, so far as constructed, will soon be tested.

A meeting of the Society of Arts will be held at Room 15, Rogers Building, on Thursday evening, Dec. 22, at 8 P. M. William Stanley, Jr., electrician of the Westinghouse Electric Light Company, of Pittsburgh, will read a paper on "Recent Improvements in Systems of Electrical Distribution." The paper will be illustrated practically.

The Boston Electric Club held its first annual dinner at its club rooms, No. 66 Boylston street, on Saturday evening, Dec. 17. The number of members who attended the dinner was fifty-eight. The president elect for 1888—Mr. P. H. Alexander—acted as toast master. The occasion was a very enjoyable one.

At the closing of the Boston Stock Exchange on Saturday, Dec. 17, telephone stocks were as follows:

Am. Bell Telephone	205
Erie Telephone	30
New England Telephone	39¾

The Bell telephone stock sold as low as 198 on Wednesday, Dec. 14. The Boston *Herald* of the following date thus accounts for this sudden decline:

"Bell telephone was sold down to 198, apparently on Drawbaugh influence. The selling was peculiar, a few shares being bought at a price and immediately offered at a lower price, showing an effort to break the price without losing much stock. At the same time dispatches came from New York quoting Drawbaugh at an advance. The latest and highest quotation for the latter was 70 bid. Nobody hereabouts will be apt to sell Bell and buy Drawbaugh until somebody knows, what nobody can know in advance, whether the United States Supreme Court will decide this way or that. All rumors upon this subject are idle gossip. Bell recovered to 202 in late dealings, and dropped to the lowest price on the final sale. It is possible that the legislative inquiry into telephone charges in New York hurts the stock of the Bell Company, which company, however, would only suffer from a possible decrease in dividends from New York sub-companies, should interference with charges have that result upon said dividends. Such loss would amount to but little." W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
PHILADELPHIA, Pa., Dec. 19, 1887.

A charter was granted by the State Department this week to the Consbohocken Electric Light and Power Company, with a capital of $20.000. Consbohocken is one of the suburbs of Philadelphia.

The merchants of Sharon, Pa., have organized an electric light company with $20,000 capital stock, and have completed all the preliminary arrangements, so that work may be begun at once upon the construction of the plant.

Several times during the past week rumors have been afloat that the Western Union Telegraph Company had absorbed the Philadelphia, Reading & Pottsville system, but inquiry fails to confirm the story, and it is stated by officials of the Reading lines that they have no intention of selling out, as their lines are too valuable and profitable. The two companies work under a mutually satisfactory arrangement for the interchange of business, but it is said that the Western Union would much prefer owning or controlling the lines, as the business is now divided by reason of both companies owning and operating lines to many points on the Reading Railroad system. If the rumored transfer should prove true, the Postal (or United Lines) Company, whose lines cover but a small portion of the territory in the Eastern part of the State, would be the Western Union's only competitor for a large and profitable business.

Luther Leber, of York, Pa., was granted patent papers a week ago for an appliance by which the brilliancy of incandescent electric lights may be regulated, so that the light may be reduced as low as two candle-power or as high as the lamp has power for. The appliance consists chiefly of a series of carbon loops of different resistances within one vacuum globe, and the current is changed through these by the manipulation of a key which is turned in a manner similar to that on a gas lamp. The new lamp will be on exhibition in this city within a few days.

The Edison Electric Light Company, of this city, have called for the fourth assessment of 10 per cent. on the capital stock of the company, and the stockholders are invited to visit the company's office and inspect the plans for the proposed central lighting station with a capacity of 25,000 lights, and a total horse-power of 3,600.

President Lawrence promised last Thursday, at a meeting of City Councils Finance Committee, to ventilate the cost of city lighting. A deficiency in the appropriation for electric lighting was under consideration, and Mr. Lawrence drew from Chief Walker the statement that the present contracts for the lighting would expire Jan. 1, and that the average price per lamp per night paid by the city is 55 cents. This was enough for the President of Common Council, and he remarked impressively:

"Then I desire to inform this committee and the citizens of Philadelphia that the city of York, Pa., pays for electric light 16 cents per lamp per night, and the city of Columbia pays 18 cents and the city of Lancaster 22 cents. I also desire to state that a Philadelphia company which is charging us 55 cents per night has offered to furnish the light for York for $7 per month per lamp. I do not propose to give one dollar more for lighting the streets of Philadelphia than is paid by these little inland towns. When this appropriation comes up in Councils I will ventilate the subject."

Nearly all the companies which supply lamps for city lighting are in the Electric Trust. When this combination was formed last winter it was reported that it intended to put up prices on the city. This was not done at the time owing to a strong protest, but its officials said that they would probably advance the prices for 1888. If this is attempted some developments may be expected.

The Bell Telephone Company has for a long time had an ordinance pending before Councils, and has been desirous of pushing it through that it might open streets and put its wires under ground. This ordinance has been hung up through the efforts of the Penn Electric Company, which has a big following in Councils. It has been said that the Penn Company is anxious that the telephone company should use its (the Penn Company's) conduits for its wires, as this would insure a handsome revenue. The telephone company has replied that difficulties of electrical induction would make it almost impossible to use electric lights and telephone wires in the same or adjoining conduits, and the matter hangs fire. Conferences have been held between the representatives of the two companies for several days past, and this astounding statement was made by a member of City Councils after the last meeting: "The Penn Company will not permit the Bell ordinance to pass Common Council. An effort has been made to convince the Penn people that the Bell and Western Union companies cannot use the Penn conduit. If it should not prove successful there will be war and some fun."

President Lawrence's comparison of the cost of electric lights furnished in this city with that paid by York, Lancaster, Columbia and other inland towns of the State is regarded as the first step in the direction of an open warfare to be waged against the Electrical Trust, which, during the past year, has quietly gained control of the electrical corporations desiring franchises from the city.

"They have a monopoly now, and we will certainly have to pay as much next year as this, if not more," said Chief Walker. "So far as these inland towns are concerned, the companies make concessions for public lighting in lieu of securing an exclusive privilege in the territory. They are thus enabled to monopolize the private patronage of the town, and, of course, are willing to give the city something in return. Another point is that the lamps are all lighted under what is known as the Moon Schedule. That is, they do not light the lamps while the moon is up, and extinguish them at sunrise. The cheapness of the plant in these small towns is another thing that must be considered."

Mr. Walker believed that, after all, the most economical thing the city could do would be to build its own plant and furnish the public lighting in that way. People who think that the city is approaching perfection in the matter of electric lighting will not find much consolation in the knowledge that there are about 527 lamps to light the large area of Philadelphia, when there ought to be between 5,000 and 6,000 lamps. The city of New Orleans has just made a contract for 3,000 lamps, while all the other large cities of the country either have gone into the manufacture of the illuminant or are about to do so. E.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, Dec. 19, 1887.

The activity in all branches of the electrical business throughout the West is simply remarkable. During the past two or three months the various electric light, motor and general electrical companies have had their facilities taxed to the utmost to keep up with their orders. Not only have contracts been made of late for an unusual number of new plants, but especially in the case of electric light companies, the orders for additions to the former plants have been quite numerous.

Mr. Barton tells me that during the month of November the amount of business done by the Western office of the Thomson-Houston Company, of which he is manager, figured up $128,000 net. This is almost incredible, except to those who are acquainted with the rapid strides of electrical progress in the present day and generation.

The Western Electric is also doing considerable in the electric light line, and will probably do more as soon as the new addition to its factory, mentioned in last week's notes, shall be completed in the spring.

The Van Depoele Company is kept busy installing new street railway plants. At the present time President Stiles is in the East looking after some orders in that section. Mr. Van Depoele was also with Mr. Stiles for some little time engaged in the same business.

The Munson Belting Company have got fairly settled in their new quarters on South Canal street. This firm has been paying

considerable attention to the electric lighting, and what is required in the way of a leather belting for use in driving dynamos. Mr. Shay, of the Munson Company, is personally known to most electric light superintendents. The many orders received from electric light companies have rendered it impossible for the Munson Company to meet all the demands for their belting, so long as they remained in their old quarters. They have therefore leased the entire building they now occupy on South Canal street, and have put in quite a number of additional presses. They thus hope soon to be in a condition not only to fill all orders promptly but to carry a stock of their different sized belts. Mr. Munson, whose health has not been very good of late, has recently returned from a trip to the Hot Springs of Arkansas, looking very much improved in health. Mr. Thomas, the business manager, is at present in San Francisco, looking after some business on that coast. He is expected back about the beginning of the year.

The Railway Telegraph Supply Company is kept busy filling orders for its annunciator. These orders come not only from the West, but even from New York and other of the Eastern States. Mr. Knapp says that he is inclined to infer from this that the annunciator is popular. Of course, the company also does considerable business in general electrical supplies.

The Central Electric Company is the Western agent of the Okonite Company of New York and of several other Eastern electrical specialties. In addition to this the company is doing an increasing general electrical business. The brothers McKinlock say they have no complaint to make as to the condition of trade, as they are kept uniformly busy and seem to get their full share of trade. They received last week a communication regarding the goods they manufacture from a firm of electrical engineers in far-away India, who, of course, mentioned that they had seen their advertisement in THE ELECTRICAL WORLD.

Mr. Terry reports that the Chicago branch of the Electrical Supply Company is doing a larger business than at any previous time. There is, perhaps, no one connected with the business who is more systematic, more painstaking and more energetic in catering for business than Mr. Terry. His system of keeping track of customers and probable customers would seem to be very nearly perfection. Mr. Terry is also probably one of the shrewdest men connected with the electrical business, and the success of the branch of which he is the manager is not, therefore, to be wondered at.

Chicago is becoming more and more important as a distributing centre, and most of the electrical enterprises of the East now have their Chicago representative. All these, without exception, speak of business as being exceedingly good.

Mr. J. L. Barclay represents Holmes, Booth & Haydens, while his brother looks after the interests of the Sprague Electric Railway and Motor Co. Mr. C. C. Warren is the western manager of the U. S. Electric Lighting Co., with Mr. Shain as his principal assistant. Mr. Alexander Kempt looks after the interests of the Brush Co., Mr. W. J. Buckley those of the Fort Wayne Jenney, Mr. F. W. Horne those of the Excelsior, Leonard & Izard those of the Edison Company, and so on.

The St. Paul Gas Company, one of the pioneers in electric lighting in the Northwest, has recently decided to make a radical change in its plant. It has been operating two different arc systems, and has some 650 lights running. It has just closed a contract with the Thomson-Houston Company, through Lieut. Gilman, that company's Northwestern representative, to replace its entire electrical plant with that of the Thomson-Houston apparatus, changing the station as fast as circumstances will permit, to one in which the Thomson-Houston arc and the Westinghouse incandescent will be exclusively used.

When one visits Cleveland and the other Western cities he is again impressed with the great activity in electrical industries. Mr. Stockly tells me that the Brush Company did more business in November last than in any previous month since its organization. Mr. Potter supplemented this by mentioning some of the larger orders recently received by the company. In the way of new plants, the San Antonio Gas Company of Texas is about to start up with 100 arc lights. The Brush Company has also sold a 30 arc and 150 incandescent plant to the Birmingham (Ala.) Rolling Mills, and similar plants to the Perry Stove Company and the Highland Avenue Belt Line Railroad Company, of the same city. An arc light plant has just been shipped to Florida, and several plants have been forwarded to various places in Mexico. The company also has an order for an incandescent plant of 300 lights from the West Point (Ga.) Manufacturing Company, and for incandescent plants from the Big Falls Manufacturing Company of Charlotte, N. C., and the Whiteman Paper Company, of Danville, N. Y., as well as orders for half a dozen other plants in North and South Carolina. A plant of 30 arc and 1,750 incandescent lights has just been installed at the New York State Reformatory, Elmira.

With regard to additions, the Brush Illuminating Company, of New York, bought this fall 25 30-light machines and 800 lamps; the California Electric Light Company increased their plant 200 lights, and the San José Brush Electric Light Company, of California, is at the present time doubling its arc plant. It will have, when completed, about 250 lights.

The Brush Company is shipping motors right along, and has recently furnished a plant for an electric railway at Columbus, O. The system used is similar to that at Denver—the Short system. The Denver Company, by the way, has recently ordered another 100 h. p. generator.

It is always pleasant to chronicle the fact that a company is liberal and considerate in its treatment of its employés. The Brush Company seems to be particularly deserving of commendation in this respect. The foremen of the different departments in the factory have, with hardly an exception, been in the company's employ almost since their beginning. There are few if any of them who have not been with the Brush Company at least a decade. This fact, of course, speaks for itself and needs no comment. It has been the custom of the Brush Company to make a present of a turkey on Thanksgiving to each head of a family in its employ, or to every one connected with the establishment who is called upon to supply the Thanksgiving dinner. It will give the readers of THE ELECTRICAL WORLD an idea of the number of men employed at the Brush works when I mention that on Thanksgiving eve this year the company distributed three tons of turkeys among its workmen!

The local Brush Company and the Thomson-Houston Company are both doing an increasing business in Cleveland. This, however, does not prevent some of the other companies from looking for business in Cleveland. The Hollenden Hotel, a new building which already accommodates quite a number of guests, but is not yet completely finished, is soon to have an incandescent plant which will have about 800 lights when it starts up, though when the house is completed, next Spring, there will be 1,500 lights. The system used will be the Westinghouse, and the plant is to consist of two 500-light Westinghouse machines and two Armington & Sims engines.

One would naturally suppose that in Cleveland, the headquarters of most of the oil companies, considerable attention would be given to the matter of a lubricating oil for use in dynamos. The Union Oil Company, appreciating the importance of the matter, are now making a special oil for dynamo-electric machines, which they call "dynamo" oil. They supply this oil to several different electric light companies, and they informed me that it is meeting with a large and increasing sale among electric light superintendents. Mr. Compton, the manager, tells me he will be glad to correspond with those interested in the subject, and would also take pleasure in sending samples of the oil to electric light men.

I found the Hill Clutch Works full of orders from electric light companies. Among others recently received, Mr. Hill mentioned the following: Spokane Falls, W. T., Electric Light and Power Company, a plant consisting of two water-wheels of about 500 h. p., vertical shafting, box bearings, horizontal shaftings, clutch pulleys, etc.; Louisiana Electric Light and Power Company, New Orleans, a large order for clutch couplings, etc.; Duluth Electric Light and Power Company, clutch pulleys; F. W. Stock, Hillsdale, Mich., hangings, pulleys, couplings, etc. The Hill works recently shipped a complete plant to San Diego, Cal. They also fitted up the Thomson-Houston, Augusta, Ga., electric light plant with their clutches, and they are equipping the new addition to the Thomson-Houston factory at Lynn. In fact, Mr. Hill tells me that he gets all the work of the Thomson-Houston Company, as well as that of other electric light companies. The Brush Company's Philadelphia station was fitted up complete with pulleys, clutch couplings, etc., by the Hill Works. There are two recent plants of which Mr. Hill is especially proud. One is that of the Port Huron, Mich., Excelsior Electric Light Company, which has now been running about six or seven weeks. Notwithstanding the name, the electric light systems used are the Thomson-Houston arc and the Westinghouse alternating. The Hill Clutch Works put in all the shafting, floor stones, pulleys, couplings, etc. The other is the West Side Power Company, of Minneapolis, Minn., part of the Brush Electric Company of that city. No fewer than sixteen car loads of shaftings, pulleys, couplings, etc., were required for this plant. Mr. Hill's clutch has undoubtedly met with great success among electric light companies, and the sales are rapidly increasing. In fact, the present facilities of the firm are inadequate to supply the demand; but, as soon as work can be started, the erection of a new factory will be begun, and then Mr. Hill hopes to meet all demands.

On the breaking up of the carbon combination, the Boulton, Cleveland and Crystal Carbon companies consolidated under the name of the Standard Carbon Company, with Mr. D. A. Dangler, head of the Dangler Stove and Manufacturing Company, as President, while the other companies of the combinations went on doing business for themselves, as they had been doing before.

There have been some changes since the combination. At that time there were seventeen different companies manufacturing carbons. At the present time, I am told, there are but seven, though when the Thomson-Houston starts up the number will be increased to eight. Of the seven now running, four are located in Cleveland; the Brush, Globe, National and Standard; the other three are the Parker-Russell, of St. Louis, the Faraday, of Pittsburgh, and the Richmond of North Adams.

Mr. Boulton, of the Standard Company, estimates that the consumption of carbons during the busy months of the Winter will amount to between 5,000,000 and 6,000,000 carbon points a month and according to his figures the seven companies now in the field produce at a conservative estimate about 5,500,000 carbons monthly. Mr. Boulton says that at the present price of carbons there is no money in the business unless a company can get orders for something like a million or a million and a half carbon points a month.

The different manufacturers continue to experiment with a view to improving the quality and life of the carbon and to cheapen the cost of production. They are also putting in new and improved machinery, with the same end in view. For this reason, with the natural increase in the demand for carbons, occasioned by the rapid growth of the business, even at the present market price they hope that there will soon prove to be sufficient margin of profit in the business to insure them a fair return for their labor and investments.

Mr. Lawrence tells me that the National Carbon Company was never kept busier than at the present time. In fact, in some of the departments they are working two sets of men by the aid of the electric light, and running twenty-four hours a day. The National Company has just put in a lot of new machinery, which gives very much better results than the old. It is proposed to add about $15,000 or $20,000 worth more of improved machinery within the next few months. Mr. Lawrence, who has had an extensive experience in manufacturing, being one of the organizers of the Domestic Sewing Machine Company of New York, and later for many years prominently connected with the Brush Electro Company, believes that the problem of carbon making is to produce the best carbon for the least money. He says that the prices of carbon are still close, and that unless carbons are made in large quantities the business cannot be made to pay.

The Brush Company aims primarily to make carbons only for its own licensees, and this department of its business is kept busy supplying the users of the Brush system. The company, however, also fills orders for carbons for use in connection with other systems, though it does not particularly cater for that trade.

The other Cleveland carbon company is known as the Globe. It does not as yet do a very large business, but Mr. Rodman, the general manager, assured me that it was running up to its present capacity. It is the intention of the company soon to increase its facilities by about fifty per cent. Mr. Rodman says his carbons are meeting with very gratifying success among electric light superintendents. The aim of the company is to make a carbon to suit any current strength. Mr. M. A. Devitt, formerly of the Forest City Carbon Company, is now connected with the Globe.

Mr. W. B. Cleveland, of the Forest City Electric Works, finds it necessary to keep almost every man in his entire factory employed in manufacturing the now well-known Cleveland electric light switches. The demand for these switches from all sections of the country has been very great, and Mr. Cleveland finds it no easy matter to keep up with the orders.

Mr. A. B. Lyman, who for many years has devoted his attention to manufacturing telegraph and burglar alarm instruments and supplies, is now contemplating increasing the scope of his business and paying more attention to the later developments of electricity.

Mr. W. E. Irish, whose inventions have from time to time been mentioned in THE ELECTRICAL WORLD, has designed for use, principally in residences, a set of domestic electrical apparatus, which are exceedingly neat, and promise to become popular. These sets, which are each contained within a rubber case, and are provided with a dry battery that Mr. Irish says will last a year, are manufactured by the Globe Electric Company and sold at a reasonable price.

One cannot visit the factory of the Westinghouse Electric Company in Pittsburgh without being impressed by the evidences on all sides of the large volume of business which the company is doing. When we bear in mind that a year ago this company had comparatively only a few lights in use, we are inclined to speculate as to what the results of the next few years in the growth of the company's business will be. Mr. Wm. Lee Church, who for several years has been at the office of Westinghouse, Church, Kerr & Co. in New York, has just returned to Pittsburgh, where he is to be permanently located, looking after the interests of the Westinghouse Electric Company. Mr. Church tells me that the Westinghouse Company now has either in use or contracted for an aggregate of about 200,000 lights. He says that during the month of November contracts were closed for no fewer than 22 central stations, aggregating some 32,000 lights.

The Westinghouse Company now has in all, 85 central stations, either installed or in course of construction. About two-thirds of these are actually running. The first station, Mr. Church tells me, was sold the latter part of 1886, so that these 85 stations are virtually the result of the present year's work.

The street lighting business of the Westinghouse Company is growing very rapidly. This is a branch of the business to which the company has given considerable attention. Twenty-five c. p. lamps are placed from 50 to 350 feet apart, according to circumstances, or on each lamp post where the electric light is to supersede the ordinary gas system of street illumination, and it is found that streets can not only be lighted better in this way, but cheaper than by either gas, naphtha or anything else used for street lighting. The Westinghouse plant of this description on Staten Island is well worthy the attention, Mr. Church considers, of those interested in the subject. A different system of converters is used for this branch of the business. About twenty different Westinghouse stations now do street lighting.

After going through the works of the Westinghouse Company, and seeing how crowded the building is with workmen in every department, I was not surprised to hear that the number of men employed is about 900, and that the output of the factory is equivalent to a 2,000-light plant a day. Although the factory is very large and every foot of space is utilized, the building is insufficient for the requirements of the company. A six-story wing is now in course of erection, however, and as soon as this is completed, it will all be required for the growing business of the company.

In the laboratory I found the motor which the electricians of the Westinghouse Company have been working upon for some time. As those who have given any attention to the subject know, the difficulties in the way of a motor for use in connection with an alternating system are very considerable. It is claimed, however, that the Westinghouse Company has overcome most of these difficulties, and that although the motor is not yet quite ready to be brought before electricians or placed upon the market, good progress is being made upon it.

The Allegheny County Light Company still enjoys the monopoly of central station lighting in Pittsburgh. The company operates the Brush arc and Westinghouse incandescent—both alternating and direct—systems. It has four stations, the principal of which is in Virgin Alley. This station furnishes 220 arc lights and 2,500 incandescents, direct, in addition to 5,000 incandescent on the alternating system. The Allegheny station furnishes 2,000 lights, alternating, and the South Side station 1,500, also alternating. There are orders on hand for 2,000 additional lights, which are being put in as rapidly as the work can be done and the apparatus obtained. The new station, which it is expected will be in many respects a model of its class, will not be ready until next spring. Mr. Smith, the superintendent, regrets that he will be unable to show the station in complete running order to those who attend the Electric Light Convention, which takes place in Pittsburgh in February. The work of foundations, etc., will be sufficiently forward, however, to give an idea as to the arrangement of the station. Mr. Smith has paid much attention to the alternating system, and is to read a paper on the subject at the forthcoming convention, which will undoubtedly prove of much interest to electricians.

I found the Standard Underground Cable Co. in their new office in the Penn Building. They report a large and increasing demand for their lead covered cables, not only from electric light companies, but also from telephone companies and others. My stay in Pittsburgh was so short that I was unable to get out to the works of the Faraday Carbon Company. I understand, however, that the company is doing a good business. I was also unable to call upon several other of the electrical industries, but was told that general electrical business in Pittsburgh is quite brisk, and that all the different companies are running up to their full capacity.

In Pittsburgh I met Mr. George S. Bigelow, of the Fernoline Chemical Company, of New York. Mr. Bigelow is making a tour through the West and South in the interest of the wood preservative called fernoline, manufactured by this company. Fernoline is used by electrical companies for coating the woodwork of conduits and also for coating the ends of telegraph poles.

W. J. J.

THE TELEGRAPH.

Fire Alarms.—The Cincinnati Fire Alarm Telegraph Company has been incorporated by E. L. Ireton and others with a capital stock of $10,000.

The Gamewell System of fire alarm has been adopted by Winona, Minn.; Birmingham, Ala.; Raleigh, N. C.; Medford, Mass.; Andover, Mass., and Sioux City, Ia.

The Farmers' Congress.—The Farmers' Congress, at Chicago, adopted a resolution in favor of placing the business of telegraphy under the control of the United States Post-Office.

Small Offices in Demand.—Judging from the reports from the Pacific slope, all the small offices to let in San Francisco are being taken up by the Western Union and Postal companies as branches.

Western Union Dividend.—The Western Union Company declared its quartely dividend last week, and advanced the rate to 1¼, making 5 per cent. per annum. The earnings are very large at the present time.

Arrested on a Charge of Fraud.—Ex-Senator J. J. Kiernan has now been arrested in a suit brought by the Columbia Rolling Mill Company, some of whose stock he obtained, it is said, by misrepresentations as to his financial stability.

Withdrawing from the Pool.—A cable dispatch from London of Dec. 12 confirms the report that the French Government refuses to allow the French Cable Company to continue in the cable pool, and that that cable company has withdrawn in consequence.

Boston, Mass.—Some of the leading Stock Exchange men in Boston are exhorting the police there to raid the bucket shops. They say that the shops are robbing and demoralizing the community more every day than all the lotteries and gambling houses put together.

Celebrating the Last Spike.—Arrangements have been made by which, when the last spike on the California & Oregon Railroad is driven by Col. C. F. Crocker, the hammer will close all the telegraph circuits on the Pacific Coast, as well as fire guns and ring bells in Portland, Oregon.

Concord, N. H.—F. W. Landon & Co. have made a contract with the city of Manchester to put in a line with 100 ticker stations in the houses of the members of the fire department. Hard drawn No. 12 copper wires are to be used for the circuit, and the contract amounts to $1,450.

Bucket Shops in Philadelphia.—It is stated that the victims of some of the bucket shops in Philadelphia hope to recover the money they have lost in these concerns by bringing suit under the law which prohibits gambling, and compels the proprietors of faro banks and other gambling dens to refund money lost at such establishments.

Government Telegraphs, Holland.—It is interesting to note the results attained with the government telegraphs in Holland. The excess of expenditures over receipts is much less than formerly, but still continues, being in 1886 no less than 422,865 florins. A little over 50 per cent. of the business done is in commercial transactions and shipping news. Private and social telegrams are 39.30 per cent.

New York Board of Trade.—At a meeting of the New York Board of Trade and Transportation, held on Dec. 14, the subject of government telegraphs came up, and a resolution was introduced urging upon Congress early and favorable consideration of the plan of placing the telegraphs in charge of the Post Office department. This resolution brought out quite a debate, with the result that the Board did not pledge itself in either way on the measure.

Postal Telegraphs.—Mr. Cullom has again introduced into the United States Senate a bill for the establishment of government telegraphs as a part of the postal system. It provides for covering the country with a network of wires, to be constructed by the engineering corps of the army, and placing them in charge of the Postmaster-General, in whose department a new office is to created, that of Director-General of Telegraphs. Four million dollars is to be appropriated under the bill for the location and construction of these lines. A rate of 10 cents for each 20 words, and 5 cents for each additional 10 words, is fixed for distances under 500 miles, with an additional rate of 5 cents for each additional 250 miles. A night rate of 35 cents and a day rate of 75 cents is fixed for each 100 words for newspapers, except where the same dispatch is dropped off for more than one office, in which case the rates are 25 and 50 cents. It is decided that civil service rules shall apply to the positions to be filled in this system.

THE TELEPHONE.

Montreal, Can.—Telephonic communication has been established between Montreal, Beauharnois, Ballyfield, Ormstown, Huntingdon and Athelstan.

Ordering at the New York Markets.—It is stated that the telephone is very largely used in ordering supplies from the general markets, such as Fulton and Washington. Most of the principal dealers have telephonic connection, and supply these orders promptly by their delivery wagons.

Chinese Telephone Concession.—There are reports current that the recent death of the father of the Emperor of China may tend to endanger the concession granted to Count Mitkiewicz, Mr. Wharton Barker and others. The deceased was at the head of the liberal party in China, and had he lived there would probably have been no doubt about the enterprise. As it is, some doubt arises, and an entire change of administration, with results unfavorable to foreign enterprise is possible.

More Rumors.—A special dispatch from Washington of Dec. 17, says: "Private dispatches were received in Washington this forenoon from New York stating that a rumor was in circulation there to the effect that the Supreme Court will decide the telephone cases in favor of Drawbaugh on the ground of priority of invention. Careful inquiries were made here to ascertain whether there was any ground for such a rumor, and no basis whatever for it could be found. All dispatches sent from Washington on the subject are purely speculative."

Rochester, N. Y.—A special dispatch from Rochester, of Dec. 17, says: "The Executive Committee of the People's Telephone Association decided yesterday to recommend to that organization that annual rates of $43, $52 and $63 for residences, offices and stores, respectively, be offered the company by the protesting subscribers of this city, who have been striking for a year. The committee refused to accept an offer of $48, $60 and $72 from the company. These rates are for direct lines. The subscribers feel that they have achieved a signal victory over the Bell Telephone Company in causing it to abandon its obnoxious toll system of rates in this city, the proposed introduction of which was the cause of all the trouble."

THE ELECTRIC LIGHT.

Hamilton, Ont., is to have an addition of 21 arc lights to its street service.

Mancelona, Mich.—The Oval Wood Dish Company is to erect a plant at Mancelona.

Alton, Ill.—The contract for electric lighting at Alton was awarded recently to the Alton Gas Company.

Lewisburg, Pa.—The Lewisburg Electric Light Company has been incorporated by C Hall and others with a capital stock of $15,000.

Westerly, R. I.—Superintendent Hamiln, of the Pawtucket station, has started up the Westerly plant, which will be under the charge of Mr. J. Hodgson.

In the Comstock Mine.—The electric light has now been introduced into the celebrated Comstock silver mine, and, it is understood, with much success.

Carlisle, Pa.—The Carlisle Electric Light, Power and Steam Heating Company has been incorporated by H. S. Stewart and others with a capital stock of $5,000.

Butte, Mont.—It was advocated recently at Butte to substitute gas for electricity. The change has not been made, and the electric light service is to be increased.

Orillia, Can.—The plant at Orillia has now been erected, and 18 arc lights have already been subscribed for. Several more will be taken should the working prove satisfactory.

Dallas, Tex.—The Dallas Electric Light, Power and Manufacturing Company, which was chartered recently by L. Craddock, W. S. Simpkins and G. H. Schoelkopf, has a capital stock of $50,000.

Washington Territory.—The success of the incandescent light in the Newcastle coal mines has led the company using it to make contracts for plants to be put in all their mines throughout Washington Territory.

Jefferson City, Mo.—It is stated that a company with $100,000 capital is being formed to buy the gas and electric light plants at Jefferson City, and that $25,000 will be spent on improvements and enlargements.

North Plainfield, N. J.—The authorities of North Plainfield profess to be dissatisfied with electric lighting. The poles are to be taken down, and gasoline is to be used. The authorities have our sincere condolence.

The American System.—During the month of November the American Electric Manufacturing Company sold 1,700 arc lamps, with equipment, etc., besides 25 dynamos with projectors and lamps for Mississippi River steamers.

New Westminster, Can.—It is stated that the establishment of the New Westminster Electric Light Company is a success. Three hundred and fifty lights have been subscribed for. The capital stock of the company is $30,000.

Washington, D. C.—The American Electric Company has been notified by the district commissioners that its request for permission to lay underground wires in certain streets cannot be granted for the reason that the title to the streets vests in the United States.

Canada.—The Dominion government has granted letters patent to the Chaudiere Electric Light and Power Company, Limited, with a capital stock of $40,000. This company is formed to construct and operate all kinds of electric apparatus throughout Canada.

India.—The electric light is peculiarly fitted for hot climates, although up to the present time little has been done to introduce it outside the temperate regions of the globe. Considerable work is being done, however, in India, and the vice-regal palace at Simla is to set the new fashion by having a very large installation.

Oakland, Cal.—The Oakland Electric Light and Motor Company have bought the plant of the Pacific Coast Construction Company, at Oakland. They are now running about 150 arc lights and are to increase their power plant as soon as new machines can be got in. The stockholders, directors, etc., are mostly Oakland capitalists.

Lighting Cable for New York Harbor.—The Bishop Gutta Percha Works have secured the contract for 2,000 yards of double conductor cable for the Robbins Reef lighted buoy in New York harbor. The cable is intended for lighting up the the buoy with a 50 c. p. incandescent lamp, as mentioned by us last week. If the experiment is successful, other buoys will be lighted in the same manner.

The English Royal Yachts.—It appears likely that the two municipal royal yachts are to be fitted up with the electric light. Queen Victoria is understood, however, to desire that the new light shall not be introduced into the state apartments of the "Victoria and Albert." No objection is made to the lighting of all parts of the "Osborne" in this way. It is about time that Her Majesty enjoyed the same comforts as American millionaires.

Westchester, Pa.—The boiler of the Edison station at Westchester, Pa., exploded on Dec. 16, killing several persons and destroying the building, as well as seriously damaging the plant. Among the killed was Mr. T. W. Embree, the young superintendent, about 30 years of age, well known in electrical circles. Mr. Embree's body was recovered from the débris with much effort. The loss on the property is estimated at $25,000.

Electric Light Signaling.—Mention was made in this journal last week of long distance signaling by means of flashes of electric light directed against the clouds, in Morse alphabet. These experiments were made on land at Newcastle, England. Similar experiments are now being made at sea by two ships of the British navy. It appears that a message of four words was read when the ships were 60 knots apart. It seems to be necessary for this species of telegraphy that the clouds against which the light is flashed should be well defined and hang low.

Increase in Germany.—From figures given by Dr. Schilling, it appears that the number of electric light installations in the thirteen largest cities of Germany has increased during the last two years from 131 to 604. In that period the number of arc lamps has grown from 591 to 3,280, and of incandescents from 10,403 to 50,469. There still remains plenty of work to be done, however, as electricity furnishes only 4 per cent. of the total illumination.

A Stage Manager Killed.—A dispatch from Cincinnati, of Dec. 11, says: During the performance of "Michael Strogoff" at Robinson's Opera-House yesterday afternoon, James O'Connell, stage manager, was instantly killed by an electric shock, which also badly injured Charles Christy, a stage hand. Defective insulation of the wire leading to an electric light caused a connection with the metal speaking tube which lead to the prompter's stage. O'Connell got the full force of the current by resting his hand on the zinc-covered box from which the gas burners are controlled.

Absorbed by the American.—The Boston *Traveller* says: Consolidation seems to be the order of the day in all the larger branches of business. President Goff, of the American Electric Manufacturing Company, of New York, was in the city Saturday, in consultation with the manager, Mr. Brown, and the principal stockholders of the Electrical Development and Manufacturing Company, of this city, and he stated that an arrangement was arrived at by which the entire factory, property and patents belonging to the Electrical Development Company will be absorbed by the American Company for stock in the latter company.

Lawrence, Mass.—A recent despatch from Lawrence says: The proposition soon to be submitted to the city by the Edison Electric Illuminating Company will provide for the maintenance on the principal streets of fifty arc lamps, similar to the one which has been placed on trial at the corner of Lawrence and Common streets. These lamps will burn until midnight each night. The outlying streets, except in dangerous localities, it is proposed to light with 20 and 30 candle power incandescent lamps. It is doubtful if the incoming administration will care to meddle with the lights, but something must be done to remedy the existing evil.

Electric Lighting Development.—Commenting on a recent editorial in our columns, the New York *Graphic* says: The current number of THE ELECTRICAL WORLD is full of "chunks of wisdom." But we copy below one article from its complete pages, which is full of nuggets of truth, and replete with strong dignified statements upon an important question. As it well and truthfully says the business of electric lighting offers "one of the most inviting arenas for brains, money and labor to enter" in the whole range of business endeavor. The speculative era in the electric lighting business has passed. It is now a well grounded and substantial part of our social economy and will grow into mighty proportions within a few years."

APPLICATIONS OF POWER.

Stratford, Ont., proposes to put in an electric railroad.

Cape May, N. J.—The Cape May City Council has refused to allow the construction of an electric railway on Beach avenue inside the board walk.

Margate, England.—Steps are being taken for the incorporation of the Margate Tramways Company, which proposes to try electricity on its lines.

Bradford, England.—The corporation of Bradford seeks powers for the construction of tramways on which steam or other mechanical power or electricity is to be used.

Oxford, England.—The Great Western Railway Company is to apply to Parliament for power to construct a tramway from Oxford to Brill, to be worked by electrical or mechanical power.

Madras, India.—It is stated that arrangements have been made in London to supply the city of Madras with an electric tramway system, pending the acceptance of the offer by the authorities on the spot.

Liverpool, England.—The Corporation of Liverpool will apply to the Board of Trade for a provisional order granting it powers for the use of electrical, steam, or other than animal power on certain portions of its tramways.

Fulton Street, N. Y.—Although the tracks have been laid, the rolling stock bought, and the plant secured for the electric road on Fulton street, there is still some delay in putting the road in operation, owing to the opposition of the Bleecker street line, whose system the new line will cross.

Richmond, Pa.—The Richmond *State* of Dec. 10 devotes nearly a column to the new Sprague electric railway there, and reports such headway made that it is likely that the road will be ready for schedule operation early in January. One of the cars is already running around the big loop on Church Hill at the east end. The plant will cost about $400,000. The power station alone represents nearly $50,000. The total trackage, including yard, turn-outs, etc., will be 13 miles, and the schedule time for the regular route of 9½ miles will be about one hour.

Memphis, Tenn.—The Citizen Street Railroad Company consolidated with the Memphis Street Railroad Company last January, and now is very anxious to operate its cars by electricity. The officers are: N. Hill, president; T. Barrett, vice-president and general manage r; R. Semmes, assistant manager; S. P Read, Jr., treasurer; R. D. Frayson, secretary. The company have now 34 miles of Johnson steel rails and 4 miles of tram rail laid, making in all about 40 miles of track. Mr. Barrett says: "We would be very glad to have electric of horses and mules if we could find parties who could give us such power and make the same a success. At the present time we do not know of any such persons or of any who will agree with us on terms."

PERSONALS.

Mr. Geo. B. Prescott, Jr., is the contributor to the December *Chautauquan* of a very interesting article on electric lighting, in which he outlines the principles of the leading systems and gives a variety of facts and figures.

Death of Herr Guilleaume.—We regret to announce the death of Herr Franz Carl Guilleaume, on Dec. 1, at Sachsenhausen, Germany. Herr Guilleaume was one of the members of the well-known firm of Felten & Guilleaume, wire manufacturers at Mülheim, on the Rhine.

Death of W. S. Frear.—It is with much regret that we record the death of Mr. W. S. Frear, general manager of the Brush Electric Light Company, of Buffalo. Mr. Frear was only 27 years of age. He had rapidly risen to a prominent position in the electrical business, and had shown great aptitude and ability in connection with the Buffalo Brush Company. When that company was formed he became connected with it, and he rose rapidly to the position of cashier and secretary, becoming general manager last year. He leaves behind him a wife and one little child.

Captain Zalinski.—After about 21 years of service, First Lieut. Edmund L. Zalinski, of the United States Artillery, has received his commission as a captain. As having been prominent in the development of the pneumatic gun, Captain Zalinski is well known to-day all over the United States. In discussions having to do with military art abroad Captain Zalinski's name is frequently mentioned, and Sir Charles Dilke in a recent article refers to this novel arm and speculates on its effects in future warfare. Captain Zalinski is well known in electrical circles, where his many friends will gladly note his deserved promotion.

MISCELLANEOUS NOTES.

The Lick Telescope.—The clockwork for the Lick telescope at Mt. Hamilton, Cal., is to be regulated by electricity.

Supplies for the Northwest.—The Northwest Electric Supply and Construction Company has been organized at Seattle, Washington Territory, by F. H. Spaulding and others with a capital stock of $20,000.

Co-operative Building.—The annual meeting of the Serial Building Loan and Savings Institution is to be held on Tuesday, Jan. 17, at 5 P.M. at Room 33, Western Union Builing, 195 Broadway. Several amendments to the articles of association will then come up. The subscription books for the seventh series are now open.

Gas in Paris.—The returns of the municipal bureau of statistics in Paris, just published, but not giving figures later than 1885, show a consumption of gas in Paris of 351,446,105 cubic metres. Of this 10 per cent. only is burnt in the streets. Private consumption takes 81 per cent., although it has been often said that in Paris the use of gas in private houses was by no means large.

The Highest Award.—Mr. L. W. Burnham, the vice-president and general manager of the Electric Gas Lighting Company, of Boston, has just received advices from its European agents, the Woodhouse & Rawson Electric Supply Company, that at the American exhibition it received the highest award (diploma of honor) over all competitors for its exhibit of gas-lighting apparatus, annunciators, burglar alarms, electric bells, etc.

Errata.—In Mr. R. M. Hunter's article on an improvement in the Forbes meter, published last week, page 314, in the line just above the illustration the word "over" should read "once;" and in another place, "which then lifts the large circuit, breaking the armature *H*," should read "which then lifts the large armature *H*, breaking the circuit."

Change of Name.—Our esteemed monthly contemporary, the New York *Electrician and Electrical Engineer*, will, with the beginning of 1888, drop the first part of its present title and be known thereafter as *The Electrical Engineer*. It will also adopt some minor changes of "get up," improving even upon its present comeliness. We trust that our contemporary, which has ever set a high standard of excellence before itself, and has long been a credit to American technical journalism of the best type, will find these new departures accompanied by enhanced prosperity and the enjoyment of widening influence.

BUSINESS NOTICES.

Hine & Robertson, 45 Cortlandt st., N. Y., offer special inducements to electric light super'ts and engineers to use "Eureka" packing and other specialties. It will pay to address them.

Jordan & Gottfried, 208 Canal St., N. Y., carry a complete stock of iron and brass machine and wood screws, bolt cap and set screws, taps, dies, files, twist drills, brass and rubber tubing, rod and sheet copper, brass, German silver, steel and iron wire, shafting, tools, etc.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED DECEMBER 13, 1887.

374,580. Revolving Electric Hammer Tool; W. G. A. Bonville, Philadelphia Pa., Assignor to the S. S. White Dental Manufacturing Company, same place. Application filed Aug. 29, 1887. A hammer is revolved by a rotating electro-magnet. The hammer strikes the tool at each revolution.

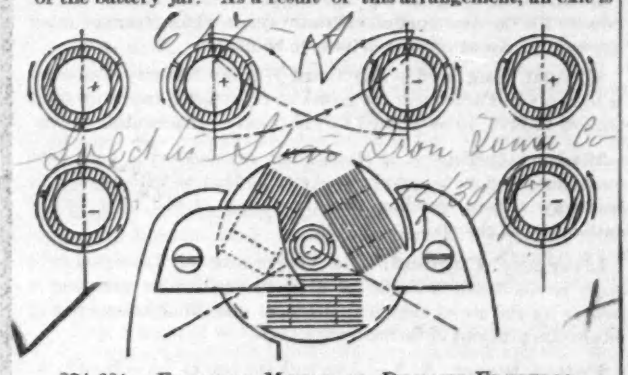
374,621. Motor or Dynamo; F. Jarvis Patten, Fort Sidney, Neb. Application filed Jan. 18, 1887. A three coil armature having the terminal extremities of its coils attached to commutator segments that extend over unequal supplementary arcs of the armature spindle, each armature coil provided with two sets of such commutators, one placed and revolving under each brush, the separator sets for each coil being secured to the armature spindle with their like parts, following each other in rotation thereon. See illustration.

374,631. Galvanic Battery; J. Serson, Boston, Mass., Assignor to J. O. Whitten, same place. Application filed Sept. 12, 1887. A perforated porous jar provided with a gutter for containing mercury and with a cup for reinforcing acid, the cup and gutter being formed integral with the jar and on the outside of the jar.

374,640. Electric Fuse; K. J. Sundström, Dover, N. J., Assignor of one-half to J. Macbeth, Brooklyn, N. Y. Application filed July 23, 1887. The usual platinum wire which becomes incandescent to fire the charge is superseded by the leading in wires themselves. They terminate in close proximity to each other and are surrounded by comminuted carbon, which becomes incandescent when current is turned on.

374,652. Circuit Breaker; C. B. Bosworth, Everett, Mass., Assignor to the Electric Gas Light Co., of Portland, Me. Application filed Jan. 17, 1887. This device is used in systems, such as gas-lighting systems, where battery is required for short spaces of time. It operates automatically to open a circuit after a certain length of time has expired should the said circuit, by accident, be held closed.

374,669. Galvanic Battery; C. R. Freeman, Hartford, Conn. (Administratrix), Assignor of one-half to David Heuney of same place. Application filed June 22, 1887. A carbon plate is supported horizontally within the jar at a considerable distance above the bottom, while the zinc plate is supported within a porous cell on the carbon plate. Both elements are perforated and traversed by a tube which opens into the lower part of the battery jar. As a result of this arrangement, an exit is



374,621. ELECTRIC MOTOR OR DYNAMO-ELECTRIC MACHINE.

formed for the spent fluid within the jar, and the fresh fluid is brought into contact with the elements. See illustration.

374,673. Automatic Circuit Closer for Secondary Batteries; W. W. Griscom, Haverford College, Pa., Assignor to the Electrical Accumulator Company, of New York. Application filed Sept. 8, 1887. When the E. M. F. of the charging current becomes sufficiently high the circuit of a magnet is closed and its armature acts through leverage to close the circuit through the battery to be charged. This condition remains so long as there is an effective charging current flowing.

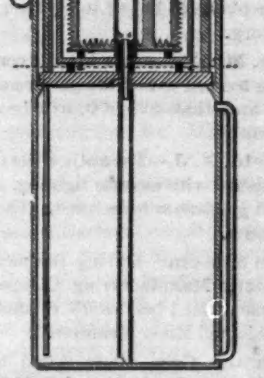
374,711. Armature; H. B. Slater, Detroit, Mich., Assignor to the Detroit Motor Company, same place. Application filed Dec. 29, 1886. This construction permits the pole pieces to be presented directly to the surface of the bobbins throughout nearly the entire length of the convolutions, while at the same time the core of the bobbins is made up of wire wound in the direction of the periphery of the armature.

374,728. Dynamo Armature; E. N. Bliss, Newark, N. J. Application filed Dec. 20, 1887. The armature and shaft are so constructed that the latter may be easily removed for repairs and replaced.

374,733. Railway Switch; S. C. C. Currie, London, Eng., Assignor to the Currie-Timmis Electric and Railway Supply Company (limited), of Philadelphia, Pa. Application filed June 3, 1887. Magnets for shifting the rails are arranged between the rails with their axes about parallel with the ties. The switches are automatically unlocked, moved and locked.

374,738. Conduit; E. E. Greene, New York, N. Y. Application filed Aug. 11, 1887. The conduit takes the place of the curb. The invention consists in details of construction, consisting of means for connecting the sections, and so forth.

374,747. Electro-Medical Apparatus; J. S. Muir, Hanford, Cal. Application filed July 1, 1887. The battery and generating coils are arranged in a case or holder like a tool handle. At one end of the holder is a frame for carrying



374,669. GALVANIC BATTERY.

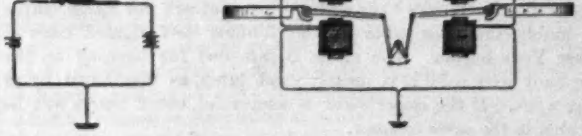
a revolving electrode, and a second electrode is attached to any part of the handle.

374,778. Motor and Generator; A. F. Congdon, Philadelphia, Pa., Assignor of two-thirds to I. Schlicter and G. E. Vickers, of same place. Application filed March 26, 1887. The frame is connected with the pole pieces by tongue and groove connection. This gives greater extent of contact surface and dispenses with the usual milling and polishing between the faces of each piece.

374,792. Conduit; G. D. Holt, of Minneapolis, Minn., Assignor of one-half to Samuel Potts, of same place. Application filed Aug. 20, 1887. A series of conduits placed one within the other with openings at the top to permit access to them.

374,842. Safety Strips for Electric Circuits; P. Lange, of Pittsburgh, and O. B. Shallenberger, of Rochester, Assignors to the Westinghouse Electric Co., of Pittsburgh, Pa. Application filed Sept. 1, 1887. Two fusible strips are arranged in a single circuit in such a manner that when one is burned out the other may be switched in.

374,843. Electric Coupling; P. Lange, Pittsburgh, Pa., Assignor to the Westinghouse Electric Company, same place. Application filed Sept. 1, 1887. A block of insulating material carries two movable connecting pins which extend through two conducting plates; the latter constitute the terminals of a circuit. The pins are normally forced outward by springs and are provided with holes to receive wires to be connected in cir-



374,888. ELECTRO MECHANICAL MOVEMENT.

cuit. These wires are passed through the perforations in the pins and into holes in the plates; the springs then force the pins upward and the wires are secured in place.

374,850. Method of Testing Electric Lamp Globes; C. F. Reinmann, Pittsburgh, Pa., Assignor to the Westinghouse Electric Company, of same place. Application filed Oct. 1, 1887. After the lamps are attached to their supporting forks they are immersed in a tank of water and air is forced into them. If bubbles rise to the surface it indicates that one or more of the globes are defective. See illustration.

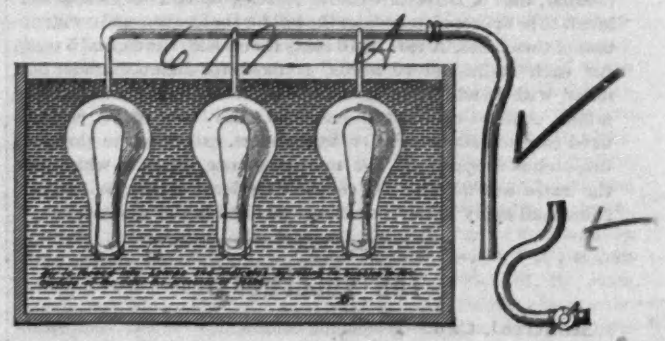
374,858. Dynamo-Electric Machine; G. Westinghouse, Jr., H. M. Byllesby, of Pittsburgh; O. B. Shallenberger, Rochester; A. Schmid, of Allegheny, and B. Hartley, Pittsburgh, Pa., said Byllesby, Shallenberger, Schmid and Hartley Assignors to said Westinghouse. Application filed Dec. 31, 1886. The invention involves many details of construction relating to the frame work of the machine, the bed-plate upon which it rests, a device for adjusting the position of the frame upon the bed for the purpose of modifying the tension of the driving belt, the construction of the pole pieces, the mounting of the armature and various other details.

(1) 374,860, (2) 374,861. Apparatus for Measuring Electric Currents; H. Aron, of Berlin, Germany. Applications filed respectively Sept. 26 and Oct. 1, 1887. (1) An improvement on the device described below. It consists in arranging an intermediate differential counter between the two clockworks, the deviations of which are to be indicated. The differential counter gears with each of the two sets of clockwork, and indicates the deviations automatically on a series of dials. (2) This system has for its object to measure quantity and electrical energy in the most simple manner. It is based upon the influence of the current upon the motion of clockwork, but the influence only affects the regulation and not the driving mechanism. A magnet through which passes the current to be measured acts upon the pendulum or other regulator.

(1) 374,862. Electric Battery; (2) 374,863. Galvanic Battery; J. A. Barrett, Brooklyn, N. Y. Application filed Aug. 30, 1887. (1) A semi-viscous material is placed above the battery elements in the jar, through which the wires pass. A solid cork is placed above this. The two together make an effectual seal for the jar. (2) The design of the inventor is to provide a battery which is compact and easy of manipulation, and to permit the battery materials and elements to be conveniently renewed. It consists in attaching the covers of the jars to an insulating slab in such a manner as to permit of their removal individually with facility. Other details are also mentioned.

(1) 374,871. Electric Motor; (2) 374,872. Apparatus for Reversing and Controlling Electric Motors and other Translating Devices; W. Hochhausen, New York, N. Y. Applications filed June 21, 1883, and Feb. 1, 1886, respectively. A variable resistance is placed in a branch to the main circuit responding to changes in the speed of the motor. With an increase in speed the amount of resistance in the branch will vary to cause less current to flow in the motor. (2) Artificial resistances are arranged in series upon the circuit, in combination with switching appliances for completing a branch around one or the other of the artificial resistances, singly, at pleasure, and in placing the electric motor in a portion of the circuit common to both branches, so that the current will pass through the motor in one direction or the other, according to which branch is closed.

374,883. Electro-Mechanical Movement; H. Van Hoevenberg, New York, Assignor of one-half to J. H. Bunnell, Brooklyn, N. Y. Application filed Dec. 15, 1886. A



374,850. METHOD OF TESTING ELECTRIC LAMP GLOBES.

motor operated by two lines through impulses whose order may be reversed at will independently of the motor. The main shaft of the motor is in constant mechanical connection with the operating armature and is susceptible of revolution in either direction. See illustration.

374,907. Multiple Switch-Board Test-Circuit; C. E. Scribner, Chicago, Ill., Assignor to the Western Electric Company, same place. Application filed May 12, 1885. Improvement on invention covered by patent No. 305,021. Instead of finding a test-circuit to line, as in that patent, a switching apparatus and circuits are provided, whereby the portion of a busy line, which is cut off at central office, forms a portion of the circuit to ground when a test is made at any of the boards.

374,910. Regulation of Motors; W. Stanley, Jr., of Englewood, N. J., Assignor to Geo. Westinghouse, Jr., Pittsburgh, Pa. Application filed Aug. 4, 1884. A demagnetizing field circuit, a resistance line or coil and an automatic switch mechanism adapted to shunt a greater or less length of the resistance line into the demagnetizing circuit according to increase or decrease of the work of the motor.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had from this office for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.